Chapter 6. Environmental Studies

Potential environmental impacts associated with the storage, allocation, distribution, and use of water in California are complex. These actions must be carefully evaluated to document adverse impacts and identify mitigation measures to avoid or reduce impact to less than significant levels. Many environmental laws affect the State's major water supply programs and environmental concerns play a major role in water policy and planning.

In order to comply with the myriad of environmental laws and regulations, extensive data on natural and cultural resources that could be affected by a proposed project must be compiled. To document fish, wildlife, and plant resources that could be affected by north of the Delta offstream storage projects, environmental field surveys have been initiated. To date, surveys have focused on the footprint of the reservoirs. Future evaluations will target completing surveys within the reservoir footprints and on areas outside the reservoirs where conveyance facilities, roads, recreation facilities, and other structures would be located.

This chapter summarizes the major laws influencing water supply facility planning, construction, and operation, and includes a summary of results of the environmental surveys conducted to date. The data from these field surveys will be used to evaluate potential impacts of proposed program alternatives. Detailed information on the environmental surveys can be found in separate appendices.

Major Laws Affecting Water Project Planning

In the late 1960s and the 1970s, State and federal lawmakers and natural resources managers began enacting laws and developing programs to address environmental and ecosystem problems associated with water supply development. This section discusses some of the major environmental laws affecting water project planning.

Endangered Species Act

Under the federal ESA, an endangered species is one that is deemed to be in danger of extinction in all or a significant part of its range, and a threatened species is one that is considered likely to become endangered in the near future. The ESA is designed to preserve endangered and threatened species by protecting individuals of the species and their habitat, and by implementing measures that promote their recovery.

The ESA sets forth a procedure for listing species as threatened or endangered. Final decisions on listings are made by USFWS and NMFS. Presently more than 650 species have been listed in the United States, of which 110 are native to California—the largest number in any state.

Once a species is listed, Section 7 of the act requires that federal agencies, in consultation with USFWS or NMFS, ensure that their actions do not jeopardize the continued existence of the species or habitat critical for the survival of that species. The federal fish and wildlife agencies are required to provide an opinion as to whether a proposed federal action would jeopardize the species. The opinion must consider reasonable and prudent alternatives to the action that

would avoid jeopardizing the species' existence. Federal actions subject to Section 7 include issuance of federal permits such as the dredge and fill permit required under Section 404 of the federal Clean Water Act.

State and local agencies and private parties are subject to the ESA if their proposed projects require a federal permit. In addition, Section 9 of the ESA prohibits the "take" of an endangered or threatened species for which protective regulations have been adopted. "Take" has been broadly defined to include actions that harm or harass listed species or that cause significant loss of their habitat. Agencies and private parties are generally required to obtain a permit from USFWS or NMFS under Section 10(a) of the ESA before carrying out activities that may incidentally result in taking a listed species. The permit normally establishes conditions to avoid take of listed species and to compensate for habitat adversely impacted by the activities.

The ESA has been interpreted to apply not just to new projects, but also to ongoing project operation and maintenance. For example, maintenance activities along the California Aqueduct right-of-way may impact the San Joaquin kit fox, the blunt-nose leopard lizard, and the Tipton kangaroo rat, all species that have been listed as endangered. DWR initiated the Section 10(a) process to obtain a permit for the incidental take of species resulting from maintenance activities along the California Aqueduct. Another example is federal, State, and local operations in the Delta and upstream along the Sacramento River that are affected by biological opinions to protect winter-run salmon and Delta smelt.

California Endangered Species Act

The California Endangered Species Act requires that a project proponent obtain a Section 2081(b) permit to authorize the incidental take of State listed species. Should the project proponent already have a Federal Biological Opinion for species also listed by the State, DFG may authorize, under Section 2080.1, a statement of concurrence with the Federal Opinion as long as it is consistent with CESA. If additional State listed species may be affected by the project or should the State require additional conditions for State listed species, DFG may authorize, by a permit issued under Section 2081(b), the take of endangered, threatened, or candidate species. Under CESA, the project impacts must be fully mitigated and the applicant must provide assurances of adequate funding for implementation, compliance monitoring, and effectiveness of the measures identified and required for full mitigation.

Dredge and Fill Permits

Section 404 of the federal Clean Water Act regulates the discharge of dredged and fill materials into waters of the United States, including wetlands. The term "discharge of dredged and fill material" has been defined broadly to include the building of any structure involving rock, sand, soil, or other construction material in waters of the United States. No discharge may occur unless a permit is obtained from the Corps. Generally, the project proponent must agree to mitigate or have plans to mitigate environmental impacts caused by the project before a permit is issued. EPA has the authority to veto permits issued by the Corps for projects that EPA believes will have unacceptable adverse effects on municipal water supplies, fisheries, or recreational areas.

Section 404 requires that the project proponent demonstrate that a proposed project is the least environmentally damaging practicable alternative for meeting the project purposes. This requires an extensive and exhaustive evaluation of alternatives that may include non-structural alternatives. Mitigation of the proposed project is not even considered until this hurdle is passed.

Section 404 provides for the issuance of a general permit on a State, regional, or nationwide basis for certain categories of activities that will cause only minimal environmental effects. Such activities are allowed without an individual permit. Installation of a stream gaging station along a river levee is one example of an activity which falls within a nationwide permit.

The Corps also administers a permitting program under Section 10 of the 1899 Rivers and Harbors Act. Section 10 generally requires a permit for obstruction to navigable water. The scope of the permit under Section 10 is narrower than under Section 404 since the term “navigable waters” is more limited than “waters of the United States."

The majority of water development projects must comply with Section 404, Section 10, or both. For example, proposed facilities for orth of the Delta offstream storage, Phase II of the Coastal Branch for the SWP, Los Vaqueros for the Contra Costa Water District, as well as activities within Delta channels, are all subject to 404 jurisdiction and regulation.

New offstream storage facilities would probably require some type of authorization under Section 404 of the Clean Water Act (33 U.S.C. Section 1344). Section 404 regulates the placement of dredged or fill materials into the waters of the United States. The term “waters of the United States” includes any waters capable of use in interstate commerce, including use by migratory waterfowl. The term “dredged or fill material” includes virtually any material that could be used to create new storage. The Corps has the primary authority to regulate activities under Section 404. EPA has veto authority over any permit approvals of the Corps.

There are four ways that a new storage facility could achieve compliance with Section 404. First, a State or local implementing entity could obtain an individual permit under existing Section 404 authority, including implementing regulations promulgated by the Corps and the EPA. Second, a CALFED-implementing agency could proceed under a Memorandum of Understanding that is being drafted and negotiated and that outlines a process for compliance with the Section 404 (b)(1) Guidelines and other permitting issues. Third, the Corps could be the constructing entity, in which case there would be no Section 404 permit, but substantive compliance with Section 404 and the Section 404 (b)(1) Guidelines would be necessary. Fourth, an exemption could be pursued pursuant to Section 404 (r). Each of these options is explained in greater detail below.

1. **State or Local Implementing Entity Obtains Individual Permit**. Under this scenario, the implementing entity would proceed under the conventional individual permit process. This would entail completion of an alternative analysis and an analysis under the Section 404 (b)(1) Guidelines. The primary issue in this approach is the analysis of the least environmentally damaging practicable alternative (LEDPA) that achieves the project purpose. Under this analysis, a project proponent needs to

demonstrate that there are not other alternatives, such as water conservation measures, which would result in achieving the needed water supply. This approach would be the same if a federal entity (other than the Corps) were the project sponsor.

2. **CALFED-implementing Agency Proceeds under a Memorandum of Understanding.** Over the last several months, various CALFED entities have been attempting to negotiate an MOU regarding Section 404 compliance for the Stage 1 implementation. The parties which have been primarily involved in this effort include the EPA, the Corps, USBR, DWR, and CALFED staff. The draft MOU focuses on a path through the LEDPA analysis. For any proposed new surface water storage facility, the draft MOU specifies that as long as the overall CALFED program was "substantially attaining the performance measures for each of the water management tools" (all of which are part of the Stage 1 implementation), it would provide support for the Corps' LEDPA analysis that reasonable alternatives were being implemented to the maximum extent practical. The draft MOU reserves the Corps' authority to include new information in the record. The Corps would be free to analyze alternative locations for the proposed new surface storage facility. At present, negotiation efforts on the MOU have shifted to an executive level.
3. **Corps of Engineers as the Constructing Entity.** When the Corps constructs water facilities pursuant to its civil works or other authority, it does not obtain a permit for those features of a project which could be characterized as the placement of dredged or fill material. Instead, the Corps, through its Planning Branch (as opposed to the Regulatory Branch), analyzes the potential impacts and performs a Section 404 (b)(1) Guidelines analysis. This approach has the potential of streamlining the permitting process for new surface water storage facilities.
4. **Section 404 (r) Exemption.** Federal projects specifically authorized by Congress may be exempt under Section 404. Section 404 (r) states that a discharge of dredged or fill material is not prohibited if information on the effects of the discharge, including a consideration of the Section 404 (b)(1) Guidelines, is included in an EIS which has been submitted to Congress before any discharge and prior to either the authorization of the project or an appropriation of construction funds. There are few, if any, projects which have proceeded under this authorization. For this exemption to apply, the project must be a federal project. Second, there must be an EIS that includes the analysis of the impacts of the facility, including an analysis under the Section 404 (b)(1) Guidelines. Finally, Congress must authorize the project or appropriate the construction funds before any placement of dredged or fill material.

Migratory Bird Treaty Act

This federal act implements various treaties for the protection of migratory birds and prohibits the taking of birds protected by those treaties without a permit. The Secretary of the Interior is directed to determine conditions under which a taking may occur, and criminal penalties are imposed for unlawful

taking or transportation of birds. Liability imposed by this act was one of several factors leading to the decision to close the Kesterson Wildlife Refuge.

National Environmental Policy Act

NEPA directs federal agencies to prepare environmental impact statements for all major federal actions that may have a significant effect on the human environment. It states that it is the goal of the federal government to use all practicable means, consistent with other considerations of national policy, to protect and enhance the quality of the environment. It is a procedural law requiring all federal agencies to consider the environmental impacts of their proposed actions during the planning and decision-making processes. The content of an EIS is very similar to that required by the California Environmental Quality Act for a State environmental impact report.

California Environmental Quality Act

CEQA, modeled after NEPA, requires California public agency decision-makers to document and consider the environmental impacts of their actions. It requires an agency to identify ways to avoid or reduce environmental damage and to implement those measures where feasible. It also serves as a means to encourage public participation in the decision-making process. CEQA applies to all levels of California government, including the State, counties, cities, and local districts.

CEQA requires that a public agency carrying out a project with significant environmental effects prepare an environmental impact report. An EIR contains a description of the project; a discussion of the project's environmental impacts, mitigation measures, and alternatives; public comments; and the agency's responses to the comments.

NEPA does not generally require federal agencies to adopt mitigation measures or alternatives provided in the EIS. CEQA, on the other hand, does impose substantive duties on all California governmental agencies approving projects with significant environmental impacts to adopt feasible alternatives or mitigation measures that substantially lessen these impacts, unless there are overriding reasons why they cannot. When a project is subject to CEQA and NEPA, both laws encourage the agencies to cooperate in planning the project and to prepare joint environmental documents.

Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act and related acts express the policy of Congress to protect the quality of the aquatic environment as it affects the conservation, improvement, and enjoyment of fish and wildlife resources. Under this act, any federal agency that proposes to control or modify any body of water, or to issue a permit allowing control or modification of a body of water, must first consult with USFWS and State Fish and Game officials. This requires coordination early in the project planning and environmental review processes.

Public Interest Terms and Conditions

The California Water Code authorizes the State Water Resources Control Board to impose public interest terms and conditions to conserve the public interest, specifically the consideration of instream beneficial uses, when it issues permits to appropriate water. Frequently, SWRCB reserves jurisdiction to consider new instream uses and to modify permits accordingly.

Water Releases for Fish

California Fish and Game Code Section 5937 protects fisheries by requiring that the owner of any dam allow sufficient water at all times to pass the dam to keep in good condition any fisheries that may be planted or exist below the dam. In *California Trout, Inc. v. the State Water Resources Control Board* (1989), the court determined that Fish and Game Code Sections 5937 and 5946 require the SWRCB to modify the permits and licenses to the City of Los Angeles to appropriate water from Mono Lake tributaries to ensure sufficient water flows for fisheries purposes. In a subsequent case, the court of appeal ordered the Superior Court to set interim flow standards for the four tributaries that Los Angeles diverts. The Alpine County Superior Court entered a preliminary injunction prohibiting Los Angeles from diverting water whenever the Mono Lake level falls below 6,377 feet.

Streambed Alteration Agreements

Fish and Game Code Sections 1601 and 1603 require that any governmental entity or private party altering a river, stream, or lake bed, bottom or channel enter into an agreement with DFG. Where the project may substantially impact an existing fish or wildlife resource, DFG may require that the agreement include provisions designed to protect riparian habitat, fisheries, and wildlife. New water development projects and on-going maintenance activities are often subject to these sections.

Natural Community Conservation Planning

Adopted in 1991, California's Natural Community Conversation Planning Act established a program to identify the habitat needs of species before they become listed as threatened or endangered, and to develop appropriate voluntary conservation methods compatible with development and growth. This program is designed to preserve habitat for the variety of species that are dependent upon each other.

Participants in the program develop plans to protect certain habitat and will ultimately enter into agreements with DFG to ensure that the plans will be carried out. Plans must be consistent with endangered species laws. A pilot program has been established in Riverside, Orange, and San Bernardino Counties for the Coastal Sage Scrub, which exists in a habitat that has been diminishing. A number of endangered species, including the gnatcatcher, depend on this habitat. The Secretary of the Interior has endorsed this process, which may evolve into the approach of the future. Participation in these plans is not mandatory.

The Natural Community Conservation Planning Act is likely to play an important role in water development in the future. Water suppliers may

participate in plans for habitat impacted directly by new water projects and indirectly in the areas that receive water supplies.

Need for Environmental Field Studies

Taken together, all of these environmental laws require that any agency proposing a major action such as construction of a large water project must conduct an extensive field evaluation of potentially affected natural and cultural resources.

The federal Endangered Species Act requires consultation with either USFWS or NMFS when any action threatens the continued existence of a species or its critical habitat. The State Endangered Species Act requires that a project proponent obtain a Section 2081(b) permit to authorize the incidental take of a State listed species. The Fish and Wildlife Coordination Act also requires consultation with USFWS and DFG to avoid damage to fish and wildlife resources. The federal Clean Water Act requires that a permit be obtained from the Corps, which can be obtained only after the affected resources are documented and plans are developed to mitigate any impacts. A complex set of federal and State laws and policies regulate preservation of historic and cultural resources, including cemeteries. Finally, NEPA and CEQA require disclosure of affected resources, potential environmental impacts, proposed mitigation measures, and alternatives.

At least 20 environmental permits would be required before a major water storage project could proceed. Each permit requires a detailed description of the potentially affected resources as the first step in determining what is affected, identifying measures to avoid impacts, and defining measures to mitigate for unavoidable impacts. The delineation of wetlands (identifying and mapping) is the first step of discussions with the Corps regarding the Clean Water Act and in consulting with the administering agencies regarding wetland species and the Endangered Species Acts.

This initial phase of the North of Delta Offstream Storage Investigation environmental evaluation focused on listed species. These are species that are listed as threatened or endangered by the federal and State Endangered Species Acts. It also evaluated sensitive species; those that could become listed as threatened or endangered in the near future. In future studies, the potential impacts on more common species, such as migratory deer or resident fish, will be evaluated.

The following sections describe the surveys and inventories undertaken to identify the sensitive plants, fish, animals, and their potential habitats, and the cultural resources that could be affected by the water diversion and storage projects under consideration. For some species, the regulatory agencies have defined guidelines, or protocols, that describe how the surveys should be conducted. When protocols have been defined, they were followed in conducting these surveys.

Table 6-45, at the end of this chapter, lists species that could occur in the counties in the west side of the Sacramento Valley where the proposed offstream storage reservoirs are located. The lists were based on a review of the California Natural Diversity Database and other references. The purpose of environmental

field data collections and surveys is to verify the existence of these species in specific locations where offstream storage project facilities may be located. These are the species that determined the design of the various surveys and the species the survey teams were looking for in the field. Table 6-45 also shows the species that have been observed during two years of survey effort, and also the probability of other species that may be present in the area (based on preliminary habitat evaluations), but have not been observed to date.

Sacramento River Impact Analyses

An important element of the Offstream Storage Investigation is to evaluate the impact of diversions from the Sacramento River on the ecosystem. A common element of north of the Delta offstream storage alternatives is diversion from the Sacramento River during relatively higher flow periods. Options for Sacramento River diversion facilities extend from the existing Tehama-Colusa Canal intake at Red Bluff to a proposed new diversion opposite Moulton Weir, approximately 8 miles north of Colusa.

CALFED is developing a list of long- and short-term studies to address potential flow impacts of diversions for offstream storage between Colusa and Red Bluff. Short-term recommendations may include:

- Developing a daily time-step operations model to improve analysis of environmental effects of water management alternatives and operational constraints.
- Establishing new and improving existing data collection and analysis programs related to bed mobility, sediment transport, bank erosion, and channel migration.
- Completing detailed mapping of the current and historic distribution of riparian vegetation.
- Developing more detailed information on the relationship between riparian vegetation establishment and hydrologic factors that impact establishment.
- Developing a riparian establishment-geomorphic process model.

Long-term efforts should address the need for improved understanding of regulated flows on both physical and ecological processes related to maintaining riparian vegetation through adaptive management and targeted research. Several of the recommended efforts, such as data collection and analysis, updated mapping and surveys, and riparian-geomorphic process model development have been planned or are already being pursued.

Two University of California scientists, under contract with DWR, are developing tools to evaluate these impacts related to flow changes associated with offstream storage diversions. Two integrated computer-modeling efforts will quantify and assess geomorphic impacts related to meander migration patterns, and determine the associated evolution of the riverine-riparian habitat. Results from the models will be used to develop guidelines related to diversions for offstream storage.

Meander Migration Model

Eric Larsen, Ph.D., Geology Department, UC Davis, is extending the capabilities of an existing model designed to predict channel migration for a

reach of river. Implementation of the mathematical model is expected to occur in five phases:

1. Further development and calibration of an existing meander migration model.
2. Quantification of the effect of flow changes on bank erosion within two study reaches of the Sacramento River. The study reaches are at Woodson Bridge and Bidwell River State Park and are approximately 8 and 10 miles, respectively.
3. Development of an interactive model for visualization of the model results using ortho-photo overlays.
4. Coupling the model with the habitat evolution model by providing compatible output from the meander model.
5. Extending the model to the remaining reaches of the river from Red Bluff to Colusa.

Vegetation Evolution Model

Steven Greco, Ph.D., Department of Environmental Design, UC Davis, is developing a model to predict the effects of changes in flows and flood regimes on the riparian ecosystem and habitats of several indicator species. The habitat evolution model will specifically use the results from the meander migration model as input. A number of additional models will be integrated including a Land Cover Classification Model, a Riparian Vegetation Succession Model, and a Habitat Model that will focus on specific indicator species.

Aquatic Resource Assessment

Understanding how changes in hydraulics and hydrology may influence aquatic resources is integral to evaluating impacts of diversion alternatives to the Sacramento River ecosystem. Tools to evaluate the impacts of different alternative diversion scenarios on fish and food web organisms in the Sacramento River between Keswick Dam and the Delta should be identified through a proposed two-phase approach conducted over a two-year period.

Phase I: ISI has developed a Request for Qualifications, will conduct interviews, and award a contract to the selected consultant. The contractor will be responsible for coordinating and conducting interagency and stakeholder scientific review team meetings and workshops. The function of the workshops and panels will be to develop the approach or framework to create an acceptable fisheries-hydraulics relationship. Conceptual models may be discussed and developed in conjunction with developing the approach to create working and acceptable tools for impact analyses. Tools used for fishery impact analyses may consider implications of concurrent developments in fluvial-geomorphology and riparian vegetation model results, and other population dynamics or hydraulic models available. Stakeholders will be consulted on a framework for fishery impact analyses, data applications, and identification of data required to complete the work.

Phase II: ISI will contract to develop working fisheries-hydraulics tools based on the results of the scientific review team recommendations. The contractor will continue to conduct review workshops to provide progress

updates on tool development and receive feedback on specifics and application. The final product will be functional tools acceptable to agencies and stakeholders. The tools will be used to evaluate impacts on fisheries population as a result of changes in hydrology and hydraulics in the upper Sacramento River.

Wetlands Delineation

This section summarizes a two-year survey of wetlands and other "waters of the United States" within the reservoir footprints of the four potential offstream storage projects. Detailed information about the wetlands delineation can be found in Appendix B.

Stereo pairs of 1:12000 and 1:6000 scale color aerial photos were reviewed to identify wetlands and wetland vegetation prior to field studies. The aerial photography used in the wetland identifications was done in late spring 1998 to differentiate seasonal wetlands from annual grassland cover. Wetland types were identified on the photographs and representative types were selected throughout each reservoir area for field verification. Wetland delineations were made using the "routine method" as described in the 1987 *U.S. Army Corps of Engineers Wetland Delineation Manual*. Results of the wetland delineations and field verifications were used to produce a draft map of jurisdictional wetlands.

Sites Reservoir

Only 1.4 percent of the reservoir area was identified as jurisdictional wetlands. Of these jurisdictional wetlands identified within the Sites Reservoir footprint (Table 6-1), more than 76 percent are seasonal wetlands. Most of the alkaline wetlands are also "seasonal," but are vastly different in the plant species composition. The alkaline wetlands within the Sites Reservoir are located along a linear zone of deformation potentially associated with Salt Lake Fault. A small quantity (2 acres) of emergent wetland was identified within the Sites Reservoir.

The riparian areas found in the Sites Reservoir area are rarely well developed or large. The largest concentration of riparian habitat is located within the southern portion of the Sites Reservoir.

Many of the vernal pools found within the Sites and Colusa Reservoir areas are manmade (e.g., drainages blocked by roads, stock ponds, or disturbed areas within heavy clay soils) and have very low plant species diversities. Pools occurring along the northeastern edge of the Sites Reservoir tended to be larger in size and higher in plant species diversity than elsewhere.

Colusa Cell

Seasonal wetlands account for more than 84 percent of the Colusa Cell wetlands (Table 6-1). Most of the alkaline wetlands are also "seasonal" but are vastly different in the plant species composition. The alkaline wetlands within the Colusa Cell are located along a linear zone of deformation potentially associated with Salt Lake Fault. Emergent wetlands were present within the Colusa Cell in several small areas but these were not measurable using aerial photo interpretation.

The riparian areas found in the Colusa Cell were not well developed nor large. One large pool with higher plant species diversity occurs within the Colusa Cell.

Table 6-1. Jurisdictional Wetlands and Waters of the U.S. Delineation

Wetlands Type	Acreage by Reservoir			
	Sites Reservoir	Colusa Cell	Newville Reservoir	Red Bank Project
Alkaline	19	35	3	0
Emergent	2	0	6	included with seasonal
Riparian	22	11	77	76
Seasonal	153	263	304	7
Total Jurisdictional Wetlands	196	309	390	83
Streams	159	111	165	118
Ponds	16	24	66	34
Other Waters	175	135	231	152
Total Waters of U.S.	371	444	621	235
Reservoir Area	14,162	13,664	17,073	4,905

Newville Reservoir

Seasonal wetlands dominate (74 percent) the wetlands of the Newville Reservoir site (Table 6-1). Some of the wetland areas are very large in size and may form complexes with other types of wetlands including riparian areas. This site also has significant quantities of other wetland types.

Riparian areas account for more than 18 percent of the Newville Reservoir wetlands. Well-developed riparian habitat occurs along a number of the main tributaries, although patches of the invasive non-native *Ailanthus altissima* (tree of heaven) occur within some of these stands. Construction of the Newville Reservoir would result in the loss of 77 acres of good quality riparian habitat.

One small area of alkaline wetland was identified within the Salt Creek drainage. Other areas adjacent to Salt Creek and some of its tributaries supported alkaline species but were too narrow to map.

Vernal pool complexes, that is areas of concentrated pools and connecting swales, were found in several locations within the reservoir site. The pools of this reservoir alternative were of an overall higher quality when compared to the Sites and Colusa Reservoir areas.

Red Bank Project

Seasonal and emergent wetlands make up less than 9 percent of the wetland total for the Red Bank Project (Table 6-1). Many of these wetlands are located

within or adjacent to small stockponds or are associated with saturated spring-fed areas. Clay soils are relatively rare within the steep terrain that dominates both the Schoenfield and Dippingvat Reservoirs.

Riparian areas dominate (92 percent) the wetlands of this area. Riparian areas can be found throughout the two reservoirs but are best developed along South Fork Cottonwood Creek and South Fork Red Bank Creek.

Special Status Shrimp Habitat Surveys

This section describes the methods and results of the mapping of potential special status shrimp habitat at the proposed Sites, Colusa, Thomes-Newville, and Red Bank Project areas.

Under contract with DWR, Jones & Stokes Associates ecologists performed surveys of potential special status shrimp habitat at the potential reservoir sites in 1998 and 1999. The 1999 surveys were conducted to verify potential special status shrimp habitat mapped in 1998 and to survey in areas where access was unavailable in the previous surveys because of flooded creeks, washed-out roads, and issues with property owners.

Special status shrimp include species in the following categories:

- Shrimp listed or proposed for listing as threatened or endangered under the federal Endangered Species Act (50 CFR 17.11 for listed animals and various Federal Register notices for proposed species)
- Other shrimp species meeting the definition of rare, threatened, or endangered species under the California Environmental Quality Act (State CEQA Guidelines, Section 15380).

The surveys focused on identifying potential habitat for the federally listed threatened vernal pool fairy shrimp (*Branchinecta lynchi*); the federally listed endangered Conservancy fairy shrimp (*Branchinecta conservatio*); the federally listed endangered vernal pool tadpole shrimp (*Lepidurus packardi*); and the rare, non-listed "Mid-Valley" fairy shrimp. Three fairy shrimp species, which are not special status species but are found in the same types of habitat, also have the potential to occur within the proposed project areas: *Branchinecta coloradensis, Branchinecta lindahli,* and *Linderiella occidentalis*.

The 1999 surveys were conducted between April 5 and May 21. Twenty-eight days (56 person days) were spent in the field. Aerial photographs and existing data from DWR and the 1998 survey results were used to select areas most likely to support special status shrimp habitat. Potential habitat was mapped conservatively in an effort to be as inclusive as possible. Potential habitat surveyed included vernal pools, alkali flats, clay flats, ephemeral stock ponds, pools, and salt lakes. Therefore, it is likely that the results of this study represent a high estimate of habitat extent. In certain instances, such as clay flats and non-vegetated artificial habitats that had dried for the season, precise boundaries were difficult to define and were estimated using best professional judgment. Future surveys conducted using the approved, more detailed USFWS protocol could result in identification of a lesser amount of actual special status shrimp habitat.

Typical habitat for special status fairy and tadpole shrimp in California include vernal pools, ponded areas within vernal swales, rock outcrop ephemeral pools, playas, alkali flats, and salt lakes. Other kinds of depressions that hold

water of a similar volume, depth and area, and for a similar duration and seasonality, such as vernal pools and swales, also may be potential habitat. These other depressions, however, are typically artificial habitats and are unvegetated, yet bear an equal potential for supporting special status shrimp.

Pool volume is important in determining potential shrimp habitat. Deeper pools with a large surface area can more easily maintain their dissolved oxygen levels. Deep pools will also pond long enough to allow the shrimp to complete their life cycle.

Common wetland plant species that typically occur with special status shrimp species generally need the same hydrologic conditions (i.e., ponding depth, ponded surface area, ponding duration). Therefore, the presence of these plant species within a potential habitat would imply a greater potential for a population of these shrimp to be present. Conversely, pools that are dominated by vernal pool plant species that tolerate only short inundation periods will have hydrology that cannot support shrimp species (i.e., ponding duration too short, pool area too shallow). Similarly, wetland habitats that support plant species that need water year round cannot support special status shrimp species because the shrimp's cysts must dry out before they can hatch.

Therefore, potential special status shrimp habitat is defined as seasonal wetlands and other temporarily ponded areas of sufficient size (depth and area) and seasonality that may support specific vegetation. This vegetation indicates the potential for ponding for a sufficient duration to allow special status shrimp species to complete their life cycles and to maintain cool water temperatures conducive to special status shrimp species.

Unvegetated potential shrimp habitats (e.g., clay flats, road ruts, and alkali flats) were mapped to the perimeter (i.e., where the vegetation begins) or to high-water mark indicators such as drift lines or dams.

All habitats mapped during the 1998 survey effort were revisited, plus areas previously inaccessible were surveyed for additional potential special status shrimp habitat. Habitats fulfilling these criteria were mapped on U.S. Geological Survey 7.5-minute quadrangle maps. The shape and dimensions of the habitat sites were drawn and described in field notes and used to calculate habitat extent in acres.

A summary of potential special status shrimp habitat mapped in the 1998 and 1999 surveys is presented in Table 6-2. Potential habitat was mapped conservatively and the results represent a high estimate of habitat acreage. The highest quality, contiguous, potential special status shrimp habitat occurs at the Thomes-Newville Project site. A greater extent of habitat occurs at the Sites Project site area; however, this habitat is degraded by cattle activity, erosion, and debris from cattle feeding areas. The potential special status shrimp habitat at the Colusa Project site is similarly degraded by the activity of cattle, although not to the extent of the Sites Project site. Implementation of the proposed Red Bank Project would not result in impacts on special status shrimp or special status shrimp habitat.

Table 6-2. Total Acreage of Potential Special Status Shrimp Habitat

Potential Reservoir Site	Total Extent of Potential Special Status Shrimp Habitat (Acres)		
	1998 Survey	1999 Survey	Difference
Red Bank	0.0	0.0	0.0
Thomes-Newville	26	26	0
Sites	73	71	-2
Colusa Cell	12	12	0

Sites Reservoir

Grasslands and vernal pools on heavy clay soils in basin terrain characterize the Sites Reservoir area, with low ridge lines near the valley margins. Clay slumps are common along the ridges and clay flats occur in low-lying areas. The land is currently used for cattle and sheep grazing. During the 1999 surveys, 1.5 acres of potential special status shrimp habitat was determined to be incapable of supporting special status shrimp species based upon the dominant vegetation within those habitats. The revised total, potential, special status shrimp habitat is 71 acres.

Colusa Cell

The terrain within the Colusa Cell is characterized by grassland and vernal pools on heavy clay soils in basin terrain with low ridge lines near the valley margins. Clay slumps are common along the ridges and clay flats occur in low-lying areas. Cattle grazing is the main agricultural practice in the area. During the 1998 surveys, 11.8 acres of potential special status shrimp habitat were mapped within the Colusa Cell. Potential habitat was predominantly vernal pools, clay flats, and ephemeral stock ponds. During 1999, surveys identified an additional 0.3 acres of potential special status shrimp habitat.

Thomes-Newville Project

The Thomes-Newville Project site is characterized by grassland and vernal pools on clay soils and Lodo shale in foothill-type terrain. Cattle grazing is the primary agricultural practice in this area.

Potential habitat consisted predominantly of vernal pools and ephemeral stock ponds. During the 1999 surveys, an additional 0.3 acre of potential habitat was identified, making a total of 26 acres of potential special status shrimp habitat.

Red Bank Project

The Red Bank Project consists of two main components: Schoenfield Reservoir on Red Bank Creek and Dippingvat Reservoir on South Fork Cottonwood Creek. Two smaller components include Lanyan Dam and Bluedoor Reservoir on North Fork Red Bank Creek. The terrain at this site is generally too sloped to support habitat suitable for special status shrimp species. DWR staff conducting the botanical, wetlands, wildlife, and geological studies all

indicated that the soils are well drained and there was very little to no potential habitat in any of the component cells of this project area.

The Red Bank potential offstream reservoir site does not support suitable habitat for special status shrimp species and is considered outside of the range of special status shrimp species.

Botanical Surveys

Plant communities were mapped and quantified within each reservoir site for broad scale resource inventory and assessment. See Appendix A for more information about botanical resources.

Rare plant surveys were conducted in the reservoir inundation areas according to established regulatory agency guidelines and protocols. Under these guidelines, focused habitat-specific surveys were conducted, using wandering transect methodology, between February and October in 1998 and 1999.

Sites Reservoir

Acreage estimates of mapped dominant vegetation types are presented in Table 6-3. California annual grassland was dominant at Sites Reservoir. Less than 10 percent of the vegetation in this reservoir is woodland (*Quercus* sp. or *Pinus sabiniana*), chaparral, riparian or vegetated wetland (*Eleocharis* sp.). Only six percent (923 acres) of the total inundation area of the Sites Reservoir supports oak woodland, which would be lost if the project is constructed.

Table 6-3. Acreage Estimates of the Dominant Vegetation Communities Mapped Within the Four Offstream Storage Reservoir Alternatives

Vegetation[1]	Acreage By Reservoir			
	Sites	Colusa Cell	Thomes-Newville	Red Bank
Grassland	12,602	13,540	14,492	565
Woodland (oak)	923	20	1,839	899
Woodland (foothill pine)	0	0	0	2,826
Chaparral	5	0	363	98
Riparian	52	37	64	73
Vegetated wetland	23	15	0	1
Cultivated grain	277	0	0	0
Vegetation Subtotal	13,882	13,612	16,758	4,462
Other	280	51	315	142
Total reservoir acreage	14,162	13,663	17,073	4,604

[1] Other classification refers to disturbed/developed acreage within the inundation elevations.

Colusa Cell

California annual grassland was dominant in the Colusa Cell (Table 6-3). Twenty acres of oak woodland was mapped at the Colusa Cell, which would be lost if the project is constructed.

Newville Reservoir

Acreage estimates of mapped dominant vegetation types are presented in Table 6-3. California annual grassland was dominant at the proposed Newville Reservoir site. The Newville Reservoir site supports valley and blue oak woodland vegetation more than 11 percent (1,839 acres) of the inundation area. There are good quality vernal pools with representation of common vernal pool flora; however, all the pools were grazed. No high priority species were found in any of the vernal pool habitat.

Thirty-one total occurrences of 4 low priority species and 23 occurrences of 5 priority species were identified in the Newville Reservoir site (Table 6-4).

Red Bank Project

Foothill pine woodland is the dominant vegetation in the proposed Red Bank Reservoir area. Oak woodland represents approximately 20 percent (899 acres) of the project area. The total amount of woodland habitat including foothill pine woodland and oak woodland comprises 83 percent of the vegetative cover. At this site, only 2 percent of the cover is chaparral scrub, and 12 percent (565 acres) is annual grassland. Potential habitat exists at this site for the chaparral, valley and foothill woodland, and valley and foothill grassland prioritized species. No vernal pool or alkaline wetland habitat was observed in the Red Bank Reservoir site. Ten prioritized plant species and 73 populations were found in this project area, including 39 priority species populations and 34 populations of low priority species (Table 6-4).

Table 6-4. Summary of Prioritized Plant Species Found in the Offstream Storage Reservoir Project, 1998-1999

Reservoir	Common Name (scientific name)[1]	Number of Occurrences[2]	Status[3] USFWS / CNPS
Sites	Fairy candelabra (*Androsace elongata* ssp. acuta)	3	– / List 4
	Hogwallow evax (*Hesperevax caulescens*)	3	-- / List 4
	Hoary navarretia (*Navarretia eriocephala*)	1	-- / List 4
	Tehama navarretia (*Navarretia heterandra)*	3	-- / List 4
Colusa Cell	Fairy candelabra (*Androsace elongata* ssp. acuta)	2	– / List 4
	Hogwallow evax (*Hesperevax caulescens*)	2	-- / List 4
	Hoary navarretia (*Navarretia eriocephala*)	1	-- / List 4
	Tehama navarretia (*Navarretia heterandra)*	1	-- / List 4
Thomes-Newville	Fairy candelabra (*Androsace elongata* ssp. acuta)	13	– / List 4
	Dimorphic snapdragon *(Antirrhinum subcordatum*)	7	–- / 1B
	Jepson's milk-vetch *(Astragalus rattanii* var. *Jepsonianus)*	1	-- / 1B
	Stony Creek spurge (*Chamaesyce ocellata* ssp *rattanii)*	7	-- / List 4
	Adobe lily (*Fritillaria pluriflora)*	12	SC / 1B
	Hogwallow evax (*Hesperevax caulescens*)	4	-- / List 4
	Tehama dwarf flax (*Hesperolinon tehamense)*	2	SC / 1B
	N.California black walnut (Juglans californica var. hindsii)	1	SC / 1B
	Tehama navarretia (Navarretia heterandra)	7	-- / List 4
Red Bank	Fairy candelabra (*Androsace elongata* ssp.acuta)	1	– / List 4
	Dimorphic snapdragon (*Antirrhinum subcordatum)*	23	-- / 1B
	Jepson's milkvetch (*Astragalus rattanii* var. *jepsonianus*)	*8*	-- / 1B
	Stony Creek spurge (*Chamaesyce ocellata* ssp *rattanii)*	9	-- / List 4
	Brandegee's eriastrum (*Eriastrum brandegeae)*	3	SC / 1B
	Adobe lily (*Fritillaria pluriflora)*	5	SC / 1B
	Woolly meadowfoam *(Limnanthes floccosa* ssp. *floccosa*)	1	--/ List 4
	Jepson's navarretia (*Navarretia jepsonii)*	8	– / List 4
	Tehama navarretia (*Navarretia heterandra)*	11	-- / List 4
	Sickle-fruit jewel-flower *(Streptanthus drepanoides*)	4	– / List 4

[1] Nomenclature corresponds to Skinner and Pavlik 1994;
[2] Occurrences are defined per California Native Plant Society 1999 as population findings separated by at least 0.25 miles;
[3] USFWS 1998: SC (Species of Concern); Skinner and Pavlik 1994; CNPS IB; (Plants rare, threatened or endangered in California and elsewhere); CNPS List 4 (Plants of limited distribution).

Valley Elderberry Longhorn Beetle Surveys

The valley elderberry longhorn beetle (VELB), *Desmocerus californicus dimorphus* Fisher, was listed by USFWS as threatened, with Critical Habitat on August 10, 1980 (Federal Register 45:52803-52807). Although there were no known VELB sites within the proposed reservoirs, habitat was known to exist within the project areas and known VELB locations were recorded nearby. The

purpose of this survey was to identify and record the presence of VELB and its habitat (see Appendix C for more detail).

Surveys focused on identifying potential habitat for VELB, the number of elderberry stems found measuring one inch or more, and the presence of exit holes. All drainages and adjacent savannas were checked first with aerial photographs and then by field surveying all potential habitat.

Habitat for VELB occurs at each of the four proposed reservoir sites. VELB emergence holes were found within the proposed Sites and Newville Reservoir areas. No emergence holes were found within the proposed Colusa and Red Bank Project areas. No adult beetles were observed at any of the proposed reservoir sites. Six hundred seventy-two elderberry stems were counted within the Sites Project area. Emergence holes were found on 18 individual stems. Only one stand of elderberry (consisting of 38 stems) was found within the Colusa Cell. Five hundred fifty-two stems have been counted in the Newville Reservoir area. Emergence holes have been found in 42 stems. A total of 1,001 elderberry stems were found within the proposed Red Bank Project area. Two hundred ten elderberry stems were found at the Dippingvat Reservoir site. Seven hundred ninety-one individual stems were counted at the Schoenfield Reservoir site. No emergence holes were found at either proposed reservoir area. No elderberry plants were found at either the Bluedoor or Lanyan Reservoir sites, however, potential elderberry habitat does exist at both.

Areas not surveyed prior to this report, such as areas with restricted access, conveyance facility locations, and road relocations, will need to be surveyed. Analyses will also be needed to predict how possible changes in water regimes within the channels and associated savannas downstream will affect elderberry survival and distribution.

Avian Surveys

The purpose of the avian survey effort was to identify the occurrence, density, and distribution of State and federally listed species of birds that may occur within the proposed project areas. These data provide information to help evaluate and compare the potential project effects on State and federally listed avian species and their habitats at the four proposed reservoir locations. (See Appendix K for more detail).

A compilation of State and federal listed species, California Species of Special Concern, and federal Species of Management Concern which could potentially occur within the proposed reservoirs was developed from several sources including: Natural Diversity Database, California Wildlife Habitat Relationships Program, literature review, landowner interviews, USFWS lists, and consultation with species experts.

Three methodologies were used to determine presence, density, and distribution of State and federally listed bird species at the proposed reservoir locations including monthly avian line-transects, annual bank swallow surveys, and annual owl surveys using pre-recorded calls. The avian studies were primarily confined to the area of the reservoir footprint. However, line transects extended up to 2.5 miles from the reservoir footprints along key drainages. Surveys were

initiated at the existing Funks Reservoir to document which State or federally listed avian species would use a reservoir within low elevation grassland habitats.

Line transects were established in representative habitat within proposed reservoir locations as access allowed, using standard avian line transect methodology (Emlen 1971). Transect length and initiation dates are identified in Table 6-5. Initial access for the transect surveys was obtained at different points in time, resulting in different numbers of transect repetition for each season at the four proposed project locations. Sites Reservoir data are most comprehensive as the 12.5-mile transect has been surveyed monthly since March 1997. DFG conducted avian surveys between 1980 and 1983 within the Stony and Thomes Creek watersheds as part of the fish and wildlife studies of the proposed Thomes-Newville Project.

Table 6-5. Avian Transect Lengths and Initiation Date

Reservoir Location	Transect Length	Date Initiated
Sites Reservoir	12.5 miles	March 1997
Colusa Cell	11.0 miles	October 1997
Newville Reservoir	19.5 miles	December 1998
Red Bank Project	16.0 miles	April 1998
Funks Reservoir (existing)	2.5 miles	October 1997

Line transects were surveyed either by foot or from a vehicle at a rate of two to three miles per hour. All State and federally listed avian species, California Species of Special Concern, and federal Migratory Nongame Birds of Management Concern detected were recorded. The distance from the transect line at the point of detection was recorded using a Tasco Lasersite Rangefinder. Detections were recorded on to field data sheets in 100-yard increments. Maximum range of the rangefinder of 800 yards (either side of the transect line) was used as the outer limit of the transect. State and federally listed species detected outside of the 800-yard limit were noted (presence), but not included in density estimates. Both 10X40 binoculars and a 15X60 spotting scope were used for field identification.

Information recorded included species, number of individuals, and lateral distance from the transect line at the point of first sighting. Data analyses followed methods of Balph et al. (1977). This method of line transect data analyses allows the field data to be used to determine differences in detectability between species and within the same species at different points in their life cycle, resulting in greater precision in density estimates.

Monthly transect results were consolidated into seasonal groups for density analyses. Seasons were defined based on the dates used by the California Wildlife Habitat Relationships Program for seasonal bird reports (Zeiner et. al. 1990). These seasonal breakdowns are based on documented migration and residency patterns of California species. Avian surveys were not conducted during periods of precipitation, high wind, or reduced visibility (fog or smoke).

Bank swallow surveys involved walking all permanent and ephemeral stream reaches with downcut channels during the bank swallow breeding season (May through July). All vertical banks were inspected for the presence of bank swallow

burrows. All foraging swallows species were identified. All detections of burrows or foraging bank swallows were recorded.

Owl surveys were conducted at night along the previously identified line transect routes during May or June. Sampling was initiated at dusk. Methodology involved broadcasting pre-recorded calls using a tape recorder with external speaker at half-mile intervals. Each species call (burrowing owl, short-eared owl, and long-eared owl) was broadcast for 30 seconds followed by 30 seconds of silence to detect return calls. Three repetitions of each call/listen cycle were conducted for each species at each one-half mile interval along the line transects. All owl detections were logged. Owl surveys were not conducted during periods of high wind or precipitation.

Review of existing databases indicated that nine State or federally listed avian species may occur within Tehama, Glenn, or Colusa Counties. Three of these species were identified during avian transect sampling at or near the proposed reservoir locations: southern bald eagle, bank swallow, and greater sandhill crane (Table 6-6).

Sporadic wintering use by both adult and immature bald eagles has been documented at each of the four proposed reservoir locations. Wintering use was nearly an order of magnitude greater at Funks Reservoir than at any of the proposed reservoir locations. Fish and a large concentration of waterfowl are available as prey for bald eagles wintering at Funks Reservoir. Up to five bald eagles have been observed perched around the reservoir on one date. Extensive, winter, bald eagle surveys were conducted along Thomes Creek as part of the Thomes Reservoir studies in the 1980s. These studies confirmed extensive use of Thomes Creek by wintering bald eagles. No suitable nesting habitat is present in the vicinity of Sites, Colusa, or Newville Reservoirs. An adult and an immature bald eagle were observed together within the Red Bank Project area during late April 1998. No indication of nesting, other than these two sightings during the breeding season, has been observed.

A single sighting of a bank swallow was made near the proposed Colusa Reservoir Cell during avian transect sampling. This sighting was made during late September 1998 approximately 2.5 miles east of the proposed Colusa Reservoir Cell. This sighting represents a transient or migrating bank swallow rather than a breeding season use. DFG surveys conducted at the proposed Thomes-Newville Reservoir in the early 1980s identified two small bank swallow colonies along Thomes Creek downstream from the project area. Both of these historic colony locations appear to be outside the footprint of the proposed reservoir.

Five sandhill cranes were observed flying over the Colusa Reservoir site during November 1997. No actual habitat use was observed. This observation occurred on a date when the Sacramento Valley was fogged in while the adjacent foothill areas were fog free. Under these conditions sandhill cranes may set down and use foothill annual grasslands. No other sandhill crane observations at any of the other three reservoir locations were made during the sampling effort. No sandhill crane use was recorded during the three years of intensive study conducted at Thomes-Newville Reservoir during the early 1980s.

Table 6-6. State and Federal Listed and Special Concern Avian Species Which May Occur At North of the Delta Offstream Storage Reservoirs

Species	Status	Sites	Colusa	Newville	Red Bank	Funks
Aleutian Canada Goose	FT					
American bittern	MNBMC					X
American white pelican	CSSC					X
Bank swallow	ST		X			
Barrow's goldeneye	CSSC					
Bell's sage sparrow	MNBMC					
Burrowing owl	CSSC, MNBMC	X	X	X		
California gull	CSSC	X				X
California horned lark	CSSC, MNBMC	X	X	X	X	
Common loon	CSSC, MNBMC					X
Cooper's hawk	CSSC	X	X	X	X	
Double-crested cormorant	CSSC		X			X
Ferruginous hawk	CSSC, MNBMC	X				X
Golden eagle	CSSC	X	X	X	X	X
Grasshopper sparrow	MNBMC		X			X
Greater sandhill crane	ST		X			
Hermit warbler	MNBMC					
Lark sparrow	MNBMC	X	X	X	X	
Lawrence's goldfinch	MNBMC		X		X	X
Least bittern	MNBMC					
Loggerhead shrike	CSSC, MNBMC	X	X	X	X	X
Long-billed curlew	CSSC, MNBMC	X	X	X		X
Long-eared owl	CSSC	X	X	X	X	
Merlin	CSSC	X		X	X	
Mountain plover	CSSC, MNBMC					
Northern goshawk	CSSC, MNBMC					
Northern harrier	CSSC	X	X	X	X	X
Northern spotted owl	FE, SE					
Osprey	CSSC				X	
Peregrine falcon	SE					
Prairie falcon	CSSC	X	X	X	X	X
Purple martin	CSSC					
Sharp-shinned hawk	CSSC	X	X		X	X
Short-eared owl	CSSC, MNBMC					X
Southern bald eagle	SE, FT	X	X	X	X	X

Table 6-6. continued	Status	Sites	Colusa	Newville	Red Bank	Funks
Swainson's hawk	ST					
Tri-colored blackbird	CSSC, MNBMC	X	X	X		
Vaux's swift	CSSC, MNBMC					
Western snowy plover	CSSC, MNBMC					
Western yellow-billed cuckoo	SE, MNBMC					
White-faced ibis	CSSC, MNBMC					
White-tailed kite	MNBMC	X				X
Willow flycatcher	SE					
Yellow warbler	CSSC	X				
Yellow-breasted chat	CSSC					

KEY

CSSC=California Species of Special Concern
MNBMC=Migratory Nongame Birds of Management Concern (USFWS)
SE=State Endangered
ST=State Threatened
FE=Federal Endangered
FT=Federal Threatened
FPT = Federal Proposed Threatened
X=Observed at reservoir site indicated.

Nesting habitat for peregrine falcon, northern spotted owl, yellow-billed cuckoo, greater sandhill crane, and willow flycatcher is absent from the proposed reservoir sites. Marginal Swainson's hawk nesting/foraging habitat is present at Sites, Colusa, and Newville Reservoir locations and absent at the Red Bank Project area. Habitats within the proposed reservoirs offer very limited opportunity for wintering or migration use by Aleutian Canada goose, mountain plover, peregrine falcon, greater sandhill crane, and willow flycatcher.

Thirty-six avian species classified as either California Species of Special Concern or Migratory Nongame Birds of Management Concern may occur within Tehama, Glenn, or Colusa Counties. Twenty-five of these species have been observed at or near one or more of the proposed reservoir locations including: American bittern, American white pelican, burrowing owl, California gull, California horned lark, common loon, Cooper's hawk, double-crested cormorant, ferruginous hawk, golden eagle, grasshopper sparrow, lark sparrow, Lawrence's goldfinch, loggerhead shrike, long-billed curlew, long-eared owl, merlin, northern harrier, osprey, prairie falcon, sharp-shinned hawk, short-eared owl, tri-colored blackbird, white-tailed kite, and yellow warbler (Table 6-6).

Seasonal avian density estimates developed from line transect data for each of the four proposed reservoir locations are presented in Tables 6-7 through 6-10. Seasonal avian density estimates for the existing Funks Reservoir are shown in Table 6-11.

Table 6-7. Sites Reservoir Avian Transect Results (Density in Birds/Square mile)

Species	Summer	Fall	Winter	Spring
Burrowing owl	0.24	0.05		
California horned lark	4.83	1.58	2.90	6.57
Cooper's hawk		0.03		0.06
Ferruginous hawk			0.12	
Golden eagle	0.23	0.20	0.26	0.32
Lark sparrow	NS	NS	0.47	1.46
Loggerhead shrike	0.93	1.60	1.17	0.47
Long-billed curlew			14.59	1.26
Northern harrier	0.05	0.50	1.53	0.58
Sharp-shinned hawk		0.40		0.03
Southern bald eagle			0.07	
Tri-colored blackbird				5.38
White-tailed kite	0.12			0.12
Miles of transect per season	37.5	88.0	75.0	150.5

NS=Not Sampled

Table 6-8. Colusa Cell Avian Transect Results (Density in Birds/Square Mile)

Species	Summer	Fall	Winter	Spring
Bank swallow		0.14		
Burrowing owl		0.14		0.03
California horned lark	85.00	7.38	22.63	36.66
Cooper's hawk		0.14	0.27	
Double-crested cormorant				0.10
Golden eagle	0.22	0.32	0.24	0.30
Lark sparrow	NS	NS		0.80
Loggerhead shrike	0.89	2.15	1.84	2.82
Long-billed curlew				4.53
Northern harrier	1.00	0.67	0.87	0.50
Prairie falcon		0.14		
Sandhill crane		0.67		
Sharp-shinned hawk		0.14		
Southern bald eagle		0.04	0.03	0.10
Tri-colored blackbird	41.50			20.32
Miles of transect per season	20.0	74.5	38.0	87.5

NS=Not Sampled

Table 6-9. Newville Reservoir Avian Transect Results (Density in Birds/Square Mile)

Species	Summer	Fall	Winter	Spring
California horned lark	NS	NS	0.52	0.75
Cooper's hawk	NS	NS	0.17	
Golden eagle	NS	NS	0.10	0.13
Lark sparrow	NS	NS	7.64	1.50
Loggerhead shrike	NS	NS	2.05	0.90
Merlin	NS	NS	0.04	
Northern harrier	NS	NS	0.15	0.06
Prairie falcon	NS	NS	0.05	0.12
Southern bald eagle	NS	NS	0.08	
Tri-colored blackbird	NS	NS	0.69	2.41
Miles of transect per season			58.5	58.5

NS=Not Sampled

Table 6-10. Red Bank Project Avian Transect Results (Density in Birds/Square Mile)

Species	Summer	Fall	Winter	Spring
Cooper's hawk		0.07	0.16	0.26
Golden eagle	0.09	0.25	0.30	0.32
Lark sparrow	NS	NS	0.18	4.79
Lawrence's goldfinch			0.36	0.78
Merlin				0.07
Northern harrier		0.08	1.07	0.26
Osprey				0.13
Prairie falcon			0.00	0.13
Sharp-shinned hawk		0.19	0.40	0.06
Southern bald eagle		0.11	0.05	0.26
Miles of transect per season	25.5	53.0	55.0	68.0

NS=Not Sampled

Table 6-11. Funks Reservoir Avian Transect Results (Existing Reservoir) (Density in Birds/Square Mile)

Species	Summer	Fall	Winter	Spring
American bittern	0.84			
American white pelican		0.16	0.10	
California gull		0.32	1.84	0.43
Common loon				0.21
Cooper's hawk		0.48		
Double-crested cormorant	0.37	1.43	1.11	0.33
Golden eagle			0.13	0.05
Lark sparrow	NS	NS	8.18	
Loggerhead shrike		1.43	0.49	1.07
Long-billed curlew		4.20	17.73	
Northern harrier		0.53	3.89	0.75
Prairie falcon		0.09		
Sharp-shinned hawk			0.48	
Short-eared owl				0.43
Southern bald eagle			0.82	0.21
White-tailed kite			1.14	0.14
Miles of transect per season	6.0	21.5	18.0	20.5

NS=Not Sampled

Mammal Studies

A variety of field survey methods were used to sample the mammal populations at the four alternative sites. Preliminary research included general literature searches, consultation with agency and species experts, aerial photo habitat interpretations, and landowner interviews. In addition, DFG biologists reviewed the Natural Diversity Database; Wildlife Habitat Relationship System; the Federal Register of Threatened, Endangered, and Special Status Species; the 1983 *Thomes/Newville Status Report*; and the 1987 *Final Report on Reconnaissance Level Studies of the Fish and Wildlife Resources at the Dippingvat and Schoenfield Reservoir sites* to gather additional species information for each project area. A list was then compiled which included the following potentially occurring Special Status species of mammals. While the species listed below remain the focus of survey efforts, sampling has been designed to include the detection and assessment of all mammal species. (See Appendix E for detailed information).

Table 6-12. Mammal Species Surveyed at Proposed North of the Delta Offstream Storage Reservoirs

Species	Status
American badger *(Taxidea taxus)*	CSSC
Fringed myotis *(Myotis thysanodes)*	FSCS
Long-eared myotis *(Myotis evotis)*	FSCS
Long-legged myotis *(Myotis volans)*	FSCS
Pacific fisher *(Martes pennanti pacificus)*	FSCS, CSSC, SS
Pacific western big-eared bat *(Corynorhinus townsendii townsendii)*	FSCS, CSSC, SS
Pale big-eared bat *(Corynorhinus townsendii pallescens)*	FSCS, CSSC, SS
Pallid bat *(Antrozous pallidus)*	CSSC, SS
Pine marten *(Martes americana)*	SS
Ringtail *(Bassariscus astutus)*	CFPS
San Joaquin pocket mouse *(Perognathus inornatus inornatus)*	FSCS
Small-footed myotis *(Myotis ciliolabrum)*	FSCS
Spotted bat *(Euderma maculatum)*	FSCS, CSSC
Western mastiff bat *(Eumops perotis californicus)*	FSCS, CSSC
Western red bat *(Lasiurus blossivillii)*	SS
Yuma myotis *(Myotis yumanensis)*	FSCS, CSSC

Key
CSSC = California Species of Special Concern
CFPS = California Fully Protected Species
FSCS = Federal Special Concern Species
SS = Sensitive Species

After the development of the species list, field surveys were designed to assess the presence, distribution, and, where possible, the relative abundance of the mammal species at the four alternative project sites. Field investigation methods included small mammal live trapping, mist netting, acoustical surveys, roost and hibernacula searches, track plates, photo stations, spotlighting, general habitat measurements, walking transects, road transects, and incidental observations.

Small Mammal Trapping

H.B. Sherman live traps were used by DFG staff to inventory the small mammal (rodent) populations. The trap size used was 3 x 3.5 x 9 inches, the standard for conducting small mammal inventories. Traps were set for three consecutive nights and checked and closed at sunrise. All captures were identified, measured, marked, recorded on data sheets, and released back in the field. Traps were baited with a mixture of birdseed and crushed walnuts each afternoon approximately one-half hour before sunset. The initial surveys specifically targeted habitat areas identified from aerial photo habitat interpretations that appeared to have the greatest suitability for the target species. Those areas were ground checked and extensively surveyed with high densities of traps in an attempt to maximize capture success of Special Status species such as the San Joaquin pocket mouse.

During the current efforts, trapping grids were implemented for larger sampling areas. Trapping locations, or grids, were randomly selected from each of the habitat types and designed so that the number of samples represented the amount and coverage area for each of the habitat types on the alternatives, a technique known as stratified sampling.

The trapping grids consisted of 200 traps within a 100 X 100-meter square. The grids were established by field crews using a compass and 100-meter tape. Various colors of pin flags were used to mark the grids. One pin flag was placed every ten meters on the grid and two traps were set within two meters of each point (pin flag) on the grid.

Mist nets were the primary method of inventorying bat species. Nets were set over water sources (i.e., ponds, creeks, or water troughs), across draws or narrow canyons, in front of entrances of old buildings, in woodland or forest edges, and in small clearings within a woodland or forest. Various net sizes and configurations were used. Net configurations were primarily as simple as a single net, but often involved several single nets spaced throughout an area. Other net configurations included "joining" several nets together and arranging them to form V, L, and T shapes. These configurations were used primarily in areas where there was a lot of known bat activity, but where previous capture efforts failed.

All captures were removed from the nets immediately upon capture and placed in a handling bag for later processing. Processing was conducted at the conclusion of netting efforts or when bat activity became slow. This reduced the potential for counting individuals of any particular species multiple times. Captures were all identified, measured, recorded on data sheets, recorded on the Anabat Detector, and released back into the field.

The Anabat Detector and software (Anabat) with a laptop computer or tape recorder was used to conduct acoustical surveys for free-flying bat species. It is known that free flying bats can be difficult to survey and capture and the use of acoustical surveys can greatly increase the detection of bat species in a survey area (O'Farrell and Gannon 1999). The Anabat was primarily used to record free-flying bats at the net sites during the initial efforts. As the studies progressed, other survey techniques were implemented. These techniques included recording while night driving and/or walking and at stationary points. Walking and driving surveys helped field crews identify potential trapping sites. When bats were detected, crews stopped for one minute and continued recording. If bat activity continued, an additional five minutes of recording was conducted. Those areas with a great amount of bat activity were mapped for future trapping efforts since long periods of activity probably indicates either a foraging area or a roost location.

Visual surveys were conducted during the daytime hours in rock outcroppings, out buildings, tree cavities, woodlands, and snags for evidence of bat presence. Visual inspections with the aid of a flashlight, if needed, in a rock crevice or tree cavity enabled field personnel to locate potential and existing roosts. The location of the site was recorded and if the bat could be identified without disturbing the bat, the species was recorded. No bats were removed from the roost because it could cause them to abandon their roost.

Track plates were used to identify the presence of carnivores such as the marten and fisher. Track plates were set up in 3- to 4-foot square areas. The site was prepared by raking a relatively flat surface and placing an aluminum plate on the ground. The bait included chicken parts or pieces or approximately one and one half ounces of canned mackerel.

Track plates were placed at intervals of approximately 1,000 meters. They were checked every morning by DFG field staff. Any tracks were measured, identified, photographed, and recorded on data sheets. In addition, clear tape was used to lift the tracks from the plates and transfer to data sheets.

Trailmaster Camera set-ups were used to survey for carnivores in a method similar to the track plates. Two types of Trailmaster sensors were used, infrared and motion sensors. When triggered, the sensors sent a signal to the camera, which then took a photograph. The area was baited with canned mackerel, commercial baits or scents, chicken, road-kill deer, or fish.

Each event (detection by the sensor) was recorded in the sensor's memory, which also differentiated which events were photographed. The camera setups were checked each morning by field personnel and recorded on data sheets.

Spotlight surveys were conducted by two or three person crews using hand-held Q-beam spotlights (250,000 to 1,000,000 candle power) from a vehicle traveling between 10 and 15 miles per hour. When eye shine was detected, the vehicle was stopped and DFG personnel identified the species with the aid of binoculars or a spotting scope when possible. Eye shine characteristics such as color, body size, and general behavior of the animal were useful in identifying species (Morrel 1972). Information such as location, habitat, species, time, distance traveled on the route, and weather was recorded on data sheets each night. All accessible roads in the study areas were included in spotlight surveys. Surveys began approximately one-half hour after sunset and concluded at approximately midnight.

Field personnel conducted walking transects throughout the different habitat types on the project areas. This effort was designed and implemented specifically to detect badger denning sites and rodent burrow areas. Field personnel performed walking transects between 10 and 50 meters (33 and 164 feet) apart depending on terrain and ground cover. All potential denning sites and burrow areas were measured, mapped, counted, and recorded.

Road transects were used along with small mammal trapping to determine the prey base available to carnivores and raptors using the project areas. The main prey species sampled was the California ground squirrel (*Spermophilus beecheyi*). The technique involved driving the roads throughout the project areas at approximately 10 miles per hour and counting ground squirrels within 50 meters of the travel route.

Incidental observations were recorded by field personnel while conducting other, more formal, surveys. Observations from field personnel conducting surveys for other disciplines such as botany, birds, fish, and herps were also reported to DFG and recorded. Reports from other field personnel were verified where possible.

Initial field investigations were designed and focused to detect the presence and distribution of Special Status species in the proposed reservoir areas in order to provide decision-makers with some baseline information that might assist with

assessing potential mitigation requirements. As the studies progressed, modifications were made to determine the presence and distribution of all mammal species in the alternative reservoir areas in an attempt to assess the cumulative potential impacts that would result from project construction.

General habitat measurements were made to assist with future efforts to conduct a Habitat Evaluation Procedure. Detailed vegetative inventories were conducted by DWR staff. DFG staff focused primarily on identifying habitat features such as snags, logs, burrows, and basic vegetation measurements such as plant heights and canopy cover while conducting other surveys such as trapping. This information was recorded and will be used in the future when the HEP Team is developed and begins the Habitat Suitability Index Model selection process.

As of August 13, 1999, six mammal species of Special Concern were documented at the four project areas (Table 6-13). The pallid bat (*Antrozous pallidus*) is the only species documented in all four of the project areas thus far in our efforts. The American badger (*Taxidea taxus*) and Yuma myotis (*Myotis yumanensis*) were documented in three of the sites. The western red bat (*Lasiurus blossivillii*) and ringtail (*Bassariscus astutus*) were documented in two of the sites, while the San Joaquin pocket mouse (*Perognathus inormatus inornatus*) was documented in only one of the sites.

Table 6-13. Sensitive Mammal Species by Project Area

Species	Sites	Colusa	Thomes-Newville	Red Bank
American badger	X	X	X	
Pallid bat	X	X	X	X
Ringtail	X		X	
San Joaquin pocket mouse			X	
Western red bat	X			X
Yuma myotis	X		X	X

Studies designed to evaluate the potential impacts of each of the alternatives on small mammals are not complete. Some areas have been surveyed lightly or not at all because of lack of vehicular access. Future surveys will require access to all areas throughout the year to allow a uniform effort at each of the alternative reservoir sites, which will be needed to make comparisons between the alternatives.

Fish Surveys

DFG initiated fish studies in 1997. Fish studies were conducted in the tributaries that flow through each of the four proposed project areas. Past studies were also reviewed and evaluated as part of this effort. Results and discussions of findings in past fishery studies and recently conducted surveys of fishery resources in the four proposed project areas are summarized in this section and included in Appendix D. Fishery studies conducted for the Sacramento River will be presented in a separate report.

Sites and Colusa Reservoir Projects

Fish studies for the Sites and Colusa Projects include three basic areas of study, fish resources in streams within the proposed reservoirs and in the Colusa Basin Drain, and habitat typing of the dominant streams in the proposed reservoirs (see Appendix D).

Studies of fish in streams that flow through the proposed Sites and Colusa Projects were conducted in 1998 and 1999. Thirty-six sample stations within the footprint of the project areas were seined to determine fish species composition. The stations were spread out among Hunter, Minton, Logan, Antelope, and particularly Stone Corral and Funks Creeks. Seven farm impoundment ponds in the area were also seined for fish.

Twelve species of fishes were caught in the Sites and Colusa study area in 1998 and 1999. Five species were game fishes and seven species were nongame fishes (Table 6-14).

Table 6-14. Fish Caught in the Sites Study Area in 1998 and 1999

Common Name	Scientific Name
Bluegill	*Lepomis macrochirus*
California roach	*Hesperoleucus symmetricus*
Chinook salmon	*Oncorhynchus tschawtscha*
Green sunfish	*Lepomis cyanellus*
Hitch	*Lavinia exilicauda*
Largemouth bass	*Micropterus salmoides*
Mosquitofish	*Gambusia affinis*
Red-eared sunfish	*Lepomis microlophus*
Sacramento blackfish	*Orthodon microlepidotus*
Sacramento pike minnow	*Ptychocheilus grandis*
Sacramento sucker	*Catostomus occidentalis*
Sculpin sp.	*Cottus sp.*

Hitch were found in all the creeks in the Sites and Colusa Project areas. Hitch were also present in the greatest numbers. Stone Corral Creek had the greatest diversity of fishes throughout the year, eight species, including two species of introduced game fish, bluegill and green sunfish. However, fish densities were lower, particularly for Hitch in Stone Corral than in other creeks. The next most diverse creek, Funks Creek, had only five species of fish, including one introduced game fish, largemouth bass.

Most fish captured during seining were minnows, members of the Cyprinid family. California roach are the only fish present that are adapted to spending summers in the remaining pools of intermittent streams (Moyle 1976). Very few fish found while seining, including game fish, were above 5.9 inches long, suggesting that only juvenile fish rear in these areas. Adult fish typically ascend seasonal creeks in the study area in winter and spawn there in early spring. Most of the adults migrate downstream after they spawn.

Three game fish species were found in the seven ponds that were seined: red-eared sunfish, bluegill, and largemouth bass. Red-eared sunfish were found in

one pond, bluegill were found in abundance in two ponds, and largemouth bass were found in three ponds out of the seven seined.

No species of concern or threatened or endangered species were found in this study. The species caught during the study are common in California.

Sites Reservoir

Stone Corral Creek. Eleven stations were sampled on Stone Corral Creek between July 15, 1998, and January 6, 1999. Eight species of fish were found in Stone Corral Creek, including two species of game fish, green sunfish and bluegill.

The fish that occurred at the most stations was the Sacramento pike minnow, followed by the hitch (Table 6-15). The density of fish on Stone Corral was relatively low for all species at all stations. Hitch were the dominant species in terms of density 0.8 fish/yd^2.

Table 6-15. Species Caught at Each Station and Relative Abundance in Stone Corral Creek

Species	Station Sampled											Fish/yd^2
	1	2	3	4	5	6	7	8	9	10	11	
Bluegill				X								0.002
California roach		X		X								0.02
Green sunfish			X					X	X	X	X	0.03
Hitch		X	X					X	X	X	X	0.8
Mosquitofish				X								0.002
Sacramento blackfish											X	0.2
Sacramento pike minnow			X	X	X	X		X	X		X	0.2
Sacramento sucker			X	X		X					X	0.02

Antelope Creek. Five stations were sampled on Antelope Creek between July 14, 1998, and November 25, 1998. Three species of fish were captured on Antelope Creek: green sunfish, hitch, and Sacramento pike minnow (Table 6-16). Hitch were the most abundant fish with an average density of 3.8 fish/yd^2. The Sacramento pike minnow and the green sunfish both had a relative abundance of 0.2 fish/yd^2. A single spring-run chinook salmon swam up Antelope Creek in the spring and died in a pool in early summer. Habitat in Antelope Creek does not support salmon because the creek nearly dries up each summer. The remaining water is too hot to allow salmon to survive there.

Table 6-16. Species Caught at Each Station and Relative Abundance in Antelope Creek

Species	Station Sampled					Fish/yd^2
	1	2	3	4	5	
Green sunfish		X		X	X	0.2
Hitch	X	X	X	X	X	3.8
Sacramento pike minnow				X	X	0.2

Funks Creek. A total of fifteen stations were sampled on Funks Creek between July 22, 1998, and January 8, 1999. Funks Creek had five species of fish, including one introduced game fish, largemouth bass. The most common fish in Funks Creek was the hitch, with an average density of 3.1 fish/yd^2 (Table 6-17). Hitch were caught in 11 out of 15 stations seined.

Table 6-17. Species Caught at Each Sample Station And Relative Abundance in Funks Creek

Species	Station Sampled															Fish/yd^2
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Hitch			X	X	X	X	X	X	X	X	X	X	X			3.1
Largemouth bass									X			X				0.001
Sacramento pike minnow					X	X			X				X			0.06
Sacramento Sucker					X	X			X	X			X			0.02
Sculpin														X		---

The most diverse sections of Funks Creek that were sampled were in the lower reaches, stations 5, 6, 9, 10, 12, and 13. The upper reaches of Funks Creek that were sampled either lacked fish or only one species was found. Hitch densities varied widely throughout the creek, and no one area seemed to maintain a higher population.

Colusa Cell

Hunters Creek. Three stations were seined on Hunters Creek between July 22, 1998, and August 3, 1998. Only two species of fish were found on Hunters Creek, mosquitofish and green sunfish. Both species were found in two of the three stations (Table 6-18). Mosquitofish were found in a relative abundance of 3.8 fish/yd^2, but they only occurred in abundance at one station. Green sunfish were found to have an average density of 2.3 fish/yd^2.

Table 6-18. Relative Abundance of Fish Caught in Hunters Creek

Species	Fish/yd^2
Green sunfish	2.3
Mosquitofish	3.8

Minton Creek. Minton Creek was sampled in two locations in August 1998. Hitch were found in one of those stations, at a density of 0.5 fish/yd^2.

Logan Creek. Four stations were sampled on Logan Creek in August 1998. Hitch were caught in stations 1 and 2. The average density of hitch on Logan Creek was 0.4 fish/yd^2.

Colusa Basin Drain

The Colusa Basin Drain is a natural channel that historically transported water from west side tributaries such as Willow, Funks, Stone Corral, and Freshwater Creeks to the Sacramento River. It also carried overflowing

floodwater from the Sacramento River. With the advent of agriculture in the Sacramento Valley, the CBD was channelized and dredged to carry agricultural runoff in addition to natural flows.

The CBD provides little bank cover for fish; however, some instream cover is provided by large and small woody debris. Its banks are scoured by periodic high flows and roads often run along the dikes that contain the waters of the CBD. The bottom of the CBD is largely mud. Water in the CBD is turbid and warm in the summer, and turbid and cool during the winter. The proposed diversion from the CBD for Sites and Colusa Reservoirs will be east of the town of Maxwell along the CBD.

Two fyke nets were placed in the Colusa Basin Drain, one upstream of the diversion point and one downstream, to sample fish. Periodic seining, seine and hook, and line sampling were also used to sample the fish of the CBD at the upper net location.

A total of 9 game fish and 17 nongame fish were caught (Table 6-19). The warmouth (*Lepomis gulosus*) and the largemouth bass *(Micropterus salmoides*), which were caught by USGS in 1996, were not observed in the recent surveys.

Table 6-19. Resident Fish of the Colusa Basin Drain.

Common Name	Scientific Name
Game Fish	
Black bullhead	*Ictalurus melas*
Black Crappie	*Pomoxis nigromaculatus*
Bluegill	*Lepomis macrochirus*
Brown bullhead	*Ictalurus nebulosus*
Channel catfish	*Ictalurus punctatus*
Chinook salmon	*Oncorhynchus tschawtscha*
Green sunfish	*Lepomis cyanellus*
White catfish	*Ictalurus catus*
White Crappie	*Pomoxis annularis*
Nongame Fish	
Big scale logperch	*Percina macrolepida*
California roach	*Hesperoleucus symmetricus*
Carp	*Cyprinus carpio*
Fathead minnow	*Pimephales promelas*
Goldfish	*Carassius auratus*
Hitch	*Lavinia exilicauda*
Inland silversides	*Menidia beryllina*
Mosquitofish	*Gambusia affinis*
Pacific lamprey	*Lampetra tridentata*
Sacramento blackfish	*Orthodon microlepidotus*
Sacramento pike minnow	*Ptycholcheilus grandis*
Sacramento splittail	*Pogonichthys macrolepidotus*
Sacramento sucker	*Catostomus occidentalis*
Sculpin sp.	*Cottus sp.*
Threadfin shad	*Dorosoma pretenense*
Tui chub	*Gila bicolor*
Tule perch	*Hysterocarpus traski*

Thomes-Newville Project

DFG initiated studies of the impacts on fish and wildlife of a Thomes-Newville Project in 1979 as part of DWR's Thomes-Newville Reservoir planning studies. However, the planning studies were halted in 1982. DFG completed a report of its abbreviated studies in 1983 (Brown et al. 1983). In 1998, DFG initiated studies of fish and wildlife resources of a Thomes-Newville Project as part of the North of Delta Offstream Storage Program. A brief survey of spring-run chinook salmon was conducted during the recent investigations. This section discusses recent findings and recapitulates the effort and results of the 1982 study (Brown et al. 1983).

Seining for juvenile chinook salmon in Stony and Thomes Creeks was done over three years, 1980 to 1982. Carcasses of chinook salmon were counted to estimate the number of adult salmon in Stony and Thomes Creeks. On June 13, 1979, August 18, 1980, and August 12, 1998, Thomes Creek was surveyed to enumerate spring-run chinook salmon and summer-steelhead. A fyke net was placed in the creek near the mouth of Thomes Creek to capture juvenile and larval Sacramento sucker and Sacramento pike minnows migrating to the Sacramento River. Streams in the footprint of proposed Newville Reservoir were sampled by electrofishing 1981 and 1982.

Thomes Creek

Juvenile Chinook Salmon and Steelhead

Thirteen juvenile chinook salmon were captured by seining during the 1980 sampling period (Table 6-20). These fish were caught in lower Thomes Creek from March 20 to May 24, 1980. Six juvenile chinook salmon were captured by seining during the 1981 sampling period. One of these fish was from Coleman National Fish Hatchery.

Table 6-20. Juvenile Chinook Salmon Seined from Thomes Creek in 1980 and 1981 (Brown et al. 1983).

Sample Period	Number of Weekly Seinings	Number of Fish	Average Length of Fish (in)
1980			
March	4	5	2.8
April	5	8	2.8
Total	9	13	
1981			
March	2	5	4.1
April	1	1	2.3
Total	3	6	

Seven juvenile steelhead were captured by seining in Thomes Creek in 1981. Four of these fish were probably from Coleman National Fish Hatchery. They had rounded fins and deformed dorsal fins, which are a characteristic of hatchery-grown fish.

In 1981, 206 juvenile chinook salmon were captured by fyke netting in Thomes Creek, 20 from the main stem, and 186 from the Tehama-Colusa Canal discharge canal (Tables 6-21 and 6-22).

Table 6-21. Fyke Net Catches of Juvenile Chinook Salmon from Main Stem of Thomes Creek in 1981 (Brown et al. 1983)

Sample Period	Hours Fished	Number of Salmon	Average Length of Fish (in)
February	672	0	0
March	744	9	2.7
April	648	10	3.1
May	336	1	2.7
Total	2,400	20	

Table 6-22. Fyke Net Catches of Juvenile Chinook Salmon from the Tehama-Colusa Canal Discharge Channel in Thomes Creek in 1981 and 1982 (Brown et al. 1983)

Sample Period	Number of Fish	Average Length of Fish (in)
1981		
January	1	1.4
February	126	1.3
March	59	1.3
Total	186	
1982		
January	2	1.4
February	45	1.4
March	337	1.5
Total	384	

No juvenile chinook salmon or steelhead were captured by seining or fyke netting in the main stem of Thomes Creek during the 1982 sampling period. However, 384 juvenile chinook salmon were captured by fyke netting in the Tehama-Colusa Canal discharge channel. The first fish was captured during the first week of January, but the bulk of the emigration did not occur until the third week of February.

Adult Chinook Salmon

1980-81 Fall-Run Estimate. Fifty-nine chinook salmon carcasses were tagged during 12 surveys of Thomes Creek. Twenty-three of these carcasses were recovered. From these data an estimated 155 salmon spawned in Thomes Creek during the sampling period. Live fish were first observed in the creek November 11, 1980, but the first carcass was tagged 9 days later. The last carcass was tagged on January 12, 1981.

Fifty-seven (97 percent) of the fish tagged were located in the Tehama-Colusa Canal outlet channel. Only two fish (3 percent) were tagged in the

mainstem. Observation of six redds and four live fish indicate there was some spawning activity in areas below Henleyville.

1981-82 Fall-Run Estimates. Thirty-eight chinook salmon carcasses were tagged during 10 surveys of Thomes Creek. Twenty of these carcasses were recovered. From the data an estimated 167 salmon spawned in Thomes Creek during the sampling period. All of the fish recovered were located in the Tehama-Colusa Canal outlet channel. No live fish or redd were seen in the mainstem.

1979-1980 Spring-Run Estimates. No adult anadromous salmonid was seen during the June 1979 or August 1980 spring-run chinook salmon surveys in Thomes Creek. Numerous juvenile steelhead and brown trout were seen in the area of the survey which may indicate that habitat for spring-run chinook salmon or summer steelhead may exist.

1999 Spring-Run Estimates. One adult spring-run chinook salmon was seen during August 1999 diving surveys in Thomes Creek. As in 1980, numerous juvenile steelhead and brown trout were seen in the area of the survey.

1979 Late Fall-Run. The late spawning characteristics of a few chinook salmon indicate that they were of the late fall-run. Those that spawned in late December and January were salmon of this race.

Resident Fishes and Migratory Nongame Fish

Twenty-two species of fish were observed in Thomes Creek (Table 6-23). DFG staff developed population and biomass estimates for 13 of these species (Table 6-24). Three species were gamefishes and 10 were nongame fishes. While steelhead were the most abundant fish above the Gorge, Sacramento pike minnow, Sacramento suckers, hardhead, California roach, and speckled dace were the more common fish below.

Most of the nongame fish that were caught in the reach below the gorge were juveniles, indicating that this reach serves mainly as a spawning and rearing area. Adult Sacramento suckers, Sacramento pike minnow, California roach, and hardhead migrate annually from the Sacramento River into Thomes Creek and its tributaries to spawn. Juveniles that do not emigrate immediately after hatching remain to rear until the following rainy season when water flows to the mouth.

Thomes Creek below Paskenta usually dries up except for a few residual pools scattered along the streambed during the late summer, making it impossible for resident adult fish to live throughout the summer months. Some adult game fish such as largemouth bass and smallmouth bass, bluegill, and green sunfish ascend the creek from the Sacramento River during the late spring and early summer to use these pools as spawning areas.

Table 6-23. Fish Species Found in Thomes Creek in 1982 (Brown et al. 1983).

Common Name	Scientific name
Bluegill	*Lepomis machrochirus*
Brown bullhead	*Ictalurus nebulosus*
California roach	*Lavinia symmetricus*
Carp	*Cyprinus carpio*
Channel catfish	*Ictalurus punctatus*
Golden shiner	*Notemigomus crysoleucus*
Goldfish	*Carassius auratus*
Green sunfish	*Lepomis cyanellus*
Hardhead	*Mylopharodon conocephalus*
Hitch	*Lavinia exilicauda*
Largemouth bass	*Micropterus salmoides*
Mosquitofish	*Gambusia affinis*
Pacific lamprey	*Lampetra tredentata*
Prickly sculpin	*Cottus asper*
Sacramento pike minnow	*Ptychocheilus grandis*
Sacramento sucker	*Catostomus occidentatlis*
Smallmouth bass	*Micropterus dolomeiu*
Speckled dace	*Rhinicthys osculus*
Steelhead	*Onchorynchus mykiss*
Threespine stickleback	*Gasterosteus aculeatus*
Tule perch	*Hysterocarpus traski*
White catfish	*Ictalurus catus*

Table 6-24. Average Population Estimates and Biomass Estimates for Fish Caught in Sections of Thomes Creek in 1982 (Brown et al. 1983).

Species	Average Population Estimate	Average Biomass (lb/acre)
Bluegill	3	4.5
California roach	41	10.7
Carp	90	64.2
Goldfish	1	19.2
Green sunfish	14	15.2
Hardhead	47	47.3
Hitch	1	0.4
Largemouth bass	5	8.0
Prickly sculpin	1	1.8
Sacramento pike minnow	337	89.2
Sacramento sucker	143	16.1
Speckled dace	229	16.1
Tule perch	1	0.2

Stony Creek

Juvenile Chinook Salmon and Steelhead

During the 1980 sampling period, 181 juvenile chinook salmon were caught by seining (Table 6-25). Salmon were first caught during the second week of February, while the last salmon was caught during the first week of May. During the 1981 sampling period, 73 juvenile chinook salmon were captured by seining. Fish were first captured during the third week of February while the last fish were captured during the second week of April. During the 1982 sampling period, only four juvenile chinook salmon were captured by seining. Two fish were captured during January and two were captured during the first week of March.

Table 6-25. Juvenile Chinook Salmon Seined from Stony Creek in 1980, 1981, and 1982 (Brown et al. 1983).

Sample Period	Number of Fish	Average Length of Fish (in)
1980		
February	64	1.7
March	51	1.8
April	60	2.0
May	6	3.0
Total	181	
1981		
February	5	1.5
March	64	2.1
April	4	3.0
Total	73	
1982		
January	2	3.3
March	2	1.7
Total	4	

Adult Chinook Salmon

1981-82 Fall-Run Estimates. Thirty-six chinook salmon carcasses were tagged during five surveys. Two of these were recovered. From these data, DFG estimates that 393 salmon spawned in Stony Creek during the sampling period. Twenty-five fish (69 percent) were females while 11 fish (31 percent) were males. This represents a male-female ratio of 1:2.3.

Most of the spawning activity was located in lower Stony Creek in the reach between Interstate 5 bridge and the North Diversion Dam. At least 35 redds and 29 carcasses were counted in this area.

Resident Fish Surveys

Six species of fish, two game species and four nongame species, were captured in streams potentially inundated by the Newville Reservoir. These streams include North Fork Stony Creek, Salt Creek, and Heifer Camp Creek. Rainbow trout were captured in sections of streams above the inundation line where the water is cool and cover is abundant. California roach, Sacramento pike

minnow, and Sacramento sucker, carp and green sunfish were captured in sections of streams below the inundation line. California roach, Sacramento pike minnows, and Sacramento suckers were more abundant species, while carp and green sunfish are relatively uncommon (Tables 6-26 and 6-27).

Table 6-26. Population Estimates for Fishes Caught in Selected Sections of Streams Within the Newville Reservoir Site in 1983 (Brown et al. 1983).

Species	North Fork Stony Creek	Salt Creek	Heifer Camp Creek
California roach	4	546	120
Carp	1		
Green sunfish	-	13	
Rainbow trout	-	24	8
Sacramento pike minnow	12	24	85
Sacramento sucker	> 2	45	6

Table 6-27. Average Biomass Estimates (lb/acre) for Fishes Caught in Selected Sections of Streams Within the Newville Reservoir Site in 1983 (Brown et al. 1983).

Species	North Fork Stony Creek	Salt Creek	Heifer Camp Creek
California roach	0.9	427.3	72.3
Carp	145.4	-	
Green sunfish	-	33.9	
Rainbow trout	-	74.9	18.7
Sacramento pike minnow	8	339.9	775.1
Sacramento sucker	0.09	88.3	

Upper Salt Creek supports a population of rainbow trout. Nongame fishes were not found in this area and, because of a waterfall, migratory Cyprinids cannot ascend the creek.

Twenty-eight species of fishes were observed in Stony Creek (Table 6-28). DFG staff developed population and biomass estimates for 22 of these species (Table 6-29). Nine species were game fishes and 13 were nongame fishes. Largemouth bass and bluegill were the most abundant gamefishes below Black Butte Reservoir and channel catfish and white catish were the most abundant game fishes above the Sacramento River. Sacramento pike minnows and suckers were found in all stations throughout Stony Creek, were the most abundant, and had the highest biomass for all species of fish. Prickly sculpin were found in all sections, but made up a very small portion of the total biomass. Most of the nongame fish that were caught in the reach below Black Butte Reservoir were juveniles, indicating that this reach serves mainly as a spawning and rearing area.

Table 6-28. Fish of the Stony Creek Drainage (Excludes Fish Within Newville Reservoir Site) (Brown et al. 1983).

Common Name	Scientific name
Black bullhead	*Ictalurus melas*
Black crappie	*Pomoxis melas*
Bluegill	*Lepomis machrochirus*
Brown bullhead	*Ictalurus nebulosus*
California roach	*Lavinia symmetricus*
Carp	*Cyprinus carpio*
Channel catfish	*Ictalurus punctatus*
Golden shiner	*Notemigomus crysoleucus*
Goldfish	*Carassius auratus*
Green sunfish	*Lepomis cyanellus*
Hardhead	*Mylopharodon conocephalus*
Hitch	*Lavinia exilicauda*
Largemouth bass	*Micropterus salmoides*
Mosquitofish	*Gambusia affinis*
Pacific lamprey	*Lampetra tridentata*
Prickly sculpin	*Cottus asper*
Rainbow trout	*Onchorynchus mykiss*
Redear sunfish	*Lepomis microlophus*
Sacramento blackfish	*Orthodon microlepidotus*
Sacramento pike minnow	*Ptychocheilus grandis*
Sacramento sucker	*Catostomus occidentatlis*
Smallmouth bass	*Micropterus dolomeiu*
Speckled dace	*Rhinicthys osculus*
Threadfin shad	*Dorosoma petenense*
Threespine stickleback	*Gasterosteus aculeatus*
Tule perch	*Hysterocarpus traski*
White catfish	*Ictalurus catus*
White crappie	*Pomoxis annularis*

Table 6-29. Average Population Estimates and Biomass Estimates for Fish Caught in Selected Sections of Stony Creek in 1982 (Brown et al. 1983).

Species	Average Population Estimate	Average Biomass (lb/acre)
Black crappie	8	87.4
Bluegill	19	8.0
Carp	5	64.2
Channel catfish	57	47.3
Goldfish	8	33.9
Green sunfish	7	2.7
Hardhead	9	24.1
Hitch	32	20.5
Largemouth bass	13	11.6
Mosquitofish	3	0.09
Prickly sculpin	57	11.6
Roach	200	54.4
Sacramento pike minnow	146	91.0
Sacramento sucker	96	256.9
Smallmouth bass	5	16.1
Speckled dace	318	41.9
Threadfin shad	2	0.9
Threespine stickleback	3	0.05
Tule perch	6	5.4
White catfish	30	34.8
White crappie	5	17.8

Red Bank Project

This section describes the results of current and past fish studies conducted on Red Bank and Cottonwood Creeks, the major tributaries of the Red Bank Project area. Past studies date back to 1969. Other studies reviewed include reports prepared by DFG and DWR in 1972, 1975, 1985, and 1987.

Red Bank Creek

In 1998, DFG biologists sampled fish at 28 stations within the footprint of Schoenfield Reservoir. Sixteen stations were seined on Red Bank Creek and its tributaries, Dry and Grizzly Creeks. Twelve stations were sampled on Red Bank Creek by electrofishing.

Four species of nongame fishes were observed (Table 6-30). The most common species of nongame fish found was California roach (0.588 fish/yd^2) followed by Sacramento pike minnow (0.158 fish/yd^2) (Table 6-31). Four species of resident game fish were also observed. The most common resident game fish were largemouth bass (0.009 fish/d^2). Juvenile steelhead were found in 2 of the 28 stations sampled.

Table 6-30. Nongame Fish Observed in Red Bank and Cottonwood Creeks

Common Name	Scientific Name	Cottonwood Creek (1976)	Red Bank Creek (1998)
California roach	*Hesperoleucus symmetricus*	X	X
Carp	*Cyprinus carpio*	X	
Golden shiner	*Notemigonus crysoleucas*	X	
Hardhead	*Mylopharodon conocephalus*	X	
Hitch	*Lavinia exilicauda*	X	
Mosquitofish	*Gambusia affinis*	X	
Pacific lamprey	*Lampetra tridentata*	X	X
Prickly sculpin	*Cottus asper*	X	
Sacramento pike minnow	*Ptychocheilus grandis*	X	X
Sacramento sucker	*Catostomus occidentalis*	X	X
Speckled dace	*Rhinichthys osculus*	X	
Threespine stickleback	*Gasterosteus aculeatus*	X	
Tule perch	*Hysterocarpus traski*	X	

Table 6-31. Relative Abundance of Non-Game Fish (Fish/Yard^2) Caught in Lower Cottonwood Creek, 1976, and in Red Bank Creek, 1998

Species	Cottonwood Creek (1976)	Red Bank Creek (1998)
California roach	0.003	0.588
Carp	0.003	
Hardhead	0.022	
Sacramento pike minnow	0.015	0.158
Sacramento sucker	0.006	0.091

Cottonwood Creek

Biologists conducted fisheries surveys of Cottonwood Creek from the confluence of the north fork to the mouth of Cottonwood Creek in 1976 to provide environmental documentation for reservoir planning. Observations were made by diving, seining, fyke netting, and electrofishing. Abundance estimates were made for fish caught by electrofishing. No estimates of abundance were done for fish caught in fyke nets, therefore these fish were not included in the relative abundance tables.

Thirteen species of nongame fishes were observed in Cottonwood Creek (Table 6-30). The most common species of resident nongame fish found were hardhead (0.022 fish/yd^2) and Sacramento pike minnow (0.015 fish/yd^2) (Table 6-31). Some Sacramento pike minnows and Sacramento suckers migrate to the Sacramento-San Joaquin estuary to rear and return to Cottonwood Creek as adults to spawn.

Biologists observed 10 species of resident game fish in the Cottonwood Creek system in 1976 (Table 6-32). The most common resident game fish were bluegill (0.022 fish/yd^2) and green sunfish (0.015 fish/yd^2) (Table 6-33). Steelhead were common in the higher reaches of the Cottonwood system, but not common in the lower reaches, while green sunfish and bluegill were more common in the lower reaches surveyed. No estimates of abundance were done for fish caught in fyke nets, therefore these fish were not included in the relative abundance tables.

Table 6-32. Game Fish Observed in Cottonwood Creek, 1976, and in Red Bank Creek, 1998

Common Name	Scientific Name	Cottonwood Creek	Red Bank Creek
Black bullhead	*Ictalurus melas*	X	
Bluegill	*Lepomis macrochirus*	X	X
Brown bullhead	Ictalurus nebulosus	X	
Brown trout	*Salmo trutta*	X	
Chinook salmon	*Onchorhynchus tshawytscha*	X	
Green sunfish	*Lepomis cyanellus*	X	X
Largemouth bass	*Micropterus salmoides*	X	X
Smallmouth bass	*Micropterus dolomieui*	X	
Steelhead	*Onchorhynchys mykiss*	X	X
White catfish	*Ictalurus catus*	X	

Table 6-33. Relative Abundance of Resident Game Fish (Fish/Yard^2) Caught in Lower Cottonwood Creek and in Red Bank Creek

Species	Cottonwood Creek (1976)	Red Bank Creek (1998)
Bluegill	0.022	0.001
Brown bullhead	0.006	
Green sunfish	0.015	0.001
Largemouth bass	0.003	0.009
Smallmouth bass	0.003	

Biologists found populations of juvenile steelhead in South Fork Cottonwood Creek in the Yolla Bolly Wilderness in the summer of 1976. No estimates of populations of juvenile steelhead were made. The Yolla Bolly Wilderness is well above the proposed Dippingvat Dam site. Adult steelhead were seined from the mouth of Cottonwood Creek in November 1976.

DFG estimates that Cottonwood Creek supports an average of 1,000 steelhead, based on the best estimates of biologists who were most familiar with Cottonwood Creek. Biologists found juvenile steelhead in the footprint of the proposed Schoenfield Reservoir in Red Bank Creek in 1998. They were found at a density of 0.002 fish/yd^2. Steelhead were found in 2 of 28 stations sampled.

Fall-run chinook salmon ascend Cottonwood Creek and spawn in late October through November. They spawn in Cottonwood Creek from the mouth to the confluence of North Fork Cottonwood Creek. About 53 percent of fall-run chinook salmon spawn from the mouth of Cottonwood Creek to the Interstate-5 highway bridge; 23 percent spawn from the Interstate-5 highway bridge to the confluence of Cottonwood Creek and the South Fork Cottonwood Creek; and 24 percent spawn in Cottonwood Creek between the confluence of the south and north forks. Their young begin migrating after they incubate in January. They migrate downstream from January through May. DFG estimates that an average of 3,600 fall-run chinook salmon spawn in Cottonwood Creek.

Late fall-run chinook salmon migrate up Cottonwood Creek and spawn in January. Biologists observed them spawning at the mouth of North Fork Cottonwood Creek in January 1976. Late fall-run chinook salmon young that migrate downstream in May and June are much smaller than the fall-run young at that time of year. Young late fall-run chinook salmon were caught in fyke nets near the mouth of Cottonwood Creek in May and June 1976. DFG estimates that an average of 300 late fall-run chinook salmon migrate up Cottonwood Creek.

Spring-run chinook salmon migrate up Cottonwood Creek in April and spend the summer in deep pools in South Fork Cottonwood Creek, Beegum Gulch, and North Fork Cottonwood Creek. Most are found in Beegum Gulch. Young spring-run chinook salmon migrate downstream from January through May. DFG estimates that an average of 500 spring-run chinook salmon run up Cottonwood Creek. Some young chinook salmon from the Sacramento River use the lower reach of Cottonwood Creek from Interstate-5 to the mouth for rearing during the summer and fall.

The most significant findings of these studies are the presence of fall-run chinook salmon, late fall-run chinook salmon, spring-run chinook salmon, and steelhead in Cottonwood Creek. The presence of steelhead in Red Bank Creek is also a significant finding.

Amphibian Surveys

Amphibian studies were initiated in 1997 for Sites, Colusa, and Red Bank projects. DFG collected data on occurrence, distribution, and relative abundance of amphibians at the proposed reservoir inundation areas for these projects. All aquatic habitats were categorized as to type of water body (e.g., pond, farm impoundment, vernal pool, or creeks). All ponds were measured for length, width, and depth during the initial assessment. DFG also reviewed past amphibian studies for Red Bank and Thomes-Newville Projects. A summary of the 1997 survey findings and findings of past studies are presented below. (See Appendix E for more detailed information).

Sites and Colusa Projects

California Red-Legged Frog. Surveys were conducted August 1997 to January 1998, and between the months of May through October 1998. All ponds and creeks in the study area were surveyed a minimum of four times during each of these periods. Both night and day surveys were conducted during

this time, at least two of each for each habitat site. Day surveys were performed on clear, sunny days with minimal wind. Night surveys were conducted on warm, still nights from an hour past sunset until midnight. No California red-legged frogs were found during any of these surveys.

California Tiger Salamander. The historic range of California tiger salamanders was established using distribution records. Grasslands, vernal pools, and farm pond impoundments that contained water for only part of the year were examined as potential California tiger salamander habitat sites. All ponds and vernal pools, and the surrounding territory were examined for burrows, log debris, type of terrestrial vegetation, use of land and its current condition, embankments, and surrounding topography. Each pond was then seined.

Transect and visual pond inspections were conducted at night, during storms that continued from the day into the night, and when the air temperature was between 7-10 °C (45-50 °F) or warmer during the months of November and March for the 1997-98 and 1998-99 seasons.

Dip netting and seining surveys were done twice a year for each vernal pool and intermittent pond, at least fifteen days apart. The first survey was done between March 15 and April 15, and the second between April 15 and May 15. Only ponds that would hold water for at least 10 weeks during the survey time interval were inspected.

No California tiger salamanders were found during any of these surveys.

Surveys of Common Amphibians. General herpetology surveys were done by ground searching near ponds and other habitats, transects, and night driving studies.

A total of five species were found during this survey (Table 6-34). The most prevalent species found was the bullfrog, *Rana catesbieana*, with a catch per hour effort ratio of 4.8 (ground searching method only) for adults.

Table 6-34. Amphibian Species of the Sites Project Area

Common Name	Scientific Name
Bullfrog	*Rana catasbieana*
California newt	*Taricha torosa*
California slender salamander	*Batrachoseps attenuatus*
Pacific tree frog	*Hylla regilla*
Western toad	*Bufo boreas*

Oak woodland and farm ponds were habitat where the greatest diversity of species was found. All five species of amphibians were found in this type of habitat (Table 6-35). Pacific tree frogs were found in all five habitat types.

Table 6-35. Amphibian Species Found in Each Habitat Type in the Sites Reservoir Area

Common Name	Riparian	Oak Woodland	Grassland	Farm Pond	Vernal Pool
Bullfrog	X	X	X	X	
California newt		X		X	
California slender salamander		X		X	
Pacific tree frog	X	X	X	X	X
Western toad	X	X	X	X	

Ground searches were the most productive method of locating a variety of amphibians. Representatives of all species found during the study were located via ground searches. Dip netting and seining were particularly effective in capturing semi-aquatic amphibians, and especially larval amphibians. Bullfrog larvae were found in riparian habitat, oak woodland, and farm ponds. Both pacific tree frog larvae and western toad larvae were found in farm ponds and vernal pools. Western toad larvae were also found in riparian habitat.

No threatened or endangered amphibians were found in this study. All species caught or observed are regarded as common.

Thomes-Newville Project

Surveys for amphibians at the Thomes-Newville Project were conducted by DFG from April 1981 through May 1982 at the request of DWR to provide environmental information for water project planning. No new surveys of amphibians at the Thomes-Newville Project area were undertaken during the recent investigations of offstream storage.

The amphibian surveys were done by ground searching ponds and transects, seining or night driving studies. Ground searches were done both day and night, but driving surveys were done only at night. Pitfall trapping was also done in the Thomes-Newville Project area surveys. A camera was used to photograph specimens for species verification and to maintain a general record of the find.

This 1981-1982 survey produced observations of seven amphibian species that occur within the habitats in the project area and surrounding areas (Table 6-36). No estimate of population sizes was possible because of the small number of recaptures that occurred during the pitfall trapping.

Table 6-36. Amphibians Observed in the Thomes-Newville Project Area in 1982

Common Name	Scientific Name
Black salamander	*Aneides flavipunctatus*
Bullfrog	*Rana catesbeiana*
California slender salamander	*Batrachoseps attenuatus*
Foothill yellow-legged frog	*Rana boylei*
Pacific tree frog	*Hyla regilla*
Western spadefoot toad	*Bufo boreas*
Western toad	*Spea hammondi*

Western toads and Pacific tree frogs were found in all habitat types. Some species, such as black salamanders, were much more limited in their distribution (Table 6-37).

Table 6-37. Amphibian Species Found in the Thomes-Newville Project Area in 1982 (X = found in this habitat type).

Species	Grassland	Chaparral	Oak Savannah	Pine-Oak Woodland	Riparian	Stream	Standing Water
Black salamander				X			
Bullfrog					X	X	X
California slender salamander	X	X	X	X			
Foothill yellow-legged frog					X	X	X
Pacific tree frog	X	X	X	X	X	X	X
Western spadefoot toad	X		X				
Western toad	X	X	X	X	X	X	X

Pitfall traps tended to be selective for amphibians. This trapping method failed to provide any amphibian species not found by at least one other collection method.

Although no amphibian species listed as rare or endangered was found in the project area, two species were found that are considered of special concern by the State of California because of habitat losses. These species complete their reproductive cycle in both temporary and permanent ponds found throughout the inundation area. Spadefoot toads and foothill yellow-legged frogs occur in the streams coursing through the reservoir site. The presence of these species constitutes a significant finding.

Red Bank Project

DFG conducted studies of the Red Bank Project in 1986 and in 1997-1999. The major objectives of these surveys was to search for California red-legged frogs, which are listed as federally threatened, and to conduct general herpetology surveys. Two species listed as federal and California species of special concern that could potentially occur in the area, the foothill yellow-legged frog and western spadefoot toad, were searched for during these surveys.

Historic ranges of the species searched for were established. Physical observations of the present habitat, historic records, and DFG's Natural Diversity Database were also used to establish the list of potential species that could occur in the Red Bank Project areas. The results of past surveys conducted in the Red Bank Project were also reviewed.

Surveys were conducted during the fall of 1997 and during the months of May through October 1998 for California red-legged frogs. Surveys were not conducted during the breeding or rearing period of the frogs to avoid disturbing breeding frogs, eggs, or larvae. All ponds and creeks in the study area were surveyed a minimum of four times during this five-month period in 1998. Both night and day surveys were conducted during this time, at least two of each for each habitat site. No site was sampled twice within a twenty-four hour period. Day surveys were performed on clear, sunny days with minimal wind. Night surveys were conducted on warm still nights from an hour past sunset until midnight. Photographs were also taken of the environment in which animals were found in order to confirm field notes and to document the state of the habitat at the time it was surveyed.

General amphibian surveys were done by ground searching ponds and transects, seining, or night driving studies. Ground searches were done both day and night. Driving surveys were only done at night. Seining was done during the day. General amphibian surveys were conducted year round throughout the Red Bank Project areas, when the weather was appropriate for amphibian activity.

During these studies five species of amphibians were found (Table 6-38). The most common species of amphibians observed were foothill yellow-legged frogs (14.80/hr.) and western toads (13.10/hr.). The foothill yellow-legged frogs are a species of special concern,

Table 6-38. Relative Abundance of Amphibians Observed in the Red Bank Project Area

Species	Catch per Hour	
	Cottonwood Creek	Red Bank Creek
Bullfrog	0.02	1.06
California red-legged frog		<0.01
Foothill yellow-legged frog	14.80	3.91
Pacific tree frog	0.01	1.58
Western toad	13.10	5.65

The most significant find in the current investigation was the discovery of a California red-legged frog in Sunflower Gulch, a tributary to Red Bank Creek. Another individual was observed in the same location in 1986. Extensive searches failed to find other red-legged frogs in the study area. It is probable that the population of red-legged frogs is very small at the site of the proposed Red Bank Project.

One amphibian species of special concern was plentiful throughout the Red Bank Project study area, the foothill yellow-legged frog. They were found in both Red Bank Creek and South Fork Cottonwood Creek.

Reptile Surveys

DWR requested the DFG to conduct studies of the reptiles in the proposed Sites, Colusa, and Red Bank Project areas. DFG biologists conducted the

sampling in spring and summer of 1998 and 1999. Past reptile studies for Red Bank and Thomes-Newville Projects were also reviewed.

Sites and Colusa Projects

DFG biologists looked for western pond turtles, a federal and State species of special concern, when seining or during daytime visual surveys in the project areas. Carapaces (shells) of dead turtles were also noted and measured. During periods of warm weather, biologists watched the creek when possible while traveling to and from work stations, which yielded positive results in locating Western pond turtles.

General herpetology surveys were done by ground searching near ponds, transects, and night driving studies. Ground searches were done both day and night, while driving surveys were only done at night. Searching ponds was done during the day. General herpetology surveys were conducted year round throughout the area when the weather was appropriate for reptile activity.

A total of 14 reptile species were found during this survey (Table 6-39). One species of special concern was found, the western pond turtle. Western pond turtles were found in the project area, as well as outside the reservoir footprint both upstream and downstream. Western fence lizards were the most common reptiles found (Table 6-40).

Table 6-39. Reptile Species of the Sites and Colusa Project Area

Common Name	Scientific Name	Status	
		State	Federal
Aquatic garter snake	*Thamnophis couchii*		
Common garter snake	*Thamnophis sirtalis*		
Common king snake	*Lampropeltus getula*		
Gopher snake	*Pituohpis catenifer*		
Ring neck snake	*Diadophis punctatus*		
Sharp-tailed snake	*Contia tenuis*		
Southern Alligator lizard	*Elgaria muliticoranata*		
Western fence lizard	*Sceloporus occidentalis*		
Western pond turtle	*Clemmys marmorata*	DFG: SC DFG: Protected	FSC
Western racer	*Coluber mormon*		
Western rattle snake	*Crotalus viridus*		
Western Sagebrush lizard	*Sceloporus graciosus gracilis*		
Western skink	*Eumeces skiltonianus*		
Western terrestrial garter snake	*Thamnophis elegans*		

DFG: California Department of Fish and Game
SC: Species of special concern
FSC: Federal species of special concern

Table 6-40. Catch Per Hour Effort for Each Survey Method

Common Name	Searching	Dip netting	Seining	Night Driving
Aquatic garter snake	0.0005	0.009	0	0
Common garter snake	0.02	0.04	0.02	0
Common king snake	0.003	0	0	0
Common racer	0.0002	0	0	0
Gopher snake	0.007	0.009	0	0
Ring neck snake	0.0005	0	0	0
Sharp-tailed snake	0.0005	0	0	0
Southern Alligator lizard	0.005	0	0	0
Western fence lizard	0.17	0	0	0
Western pond turtle	0.0009	0	0	0
Western rattlesnake	0.02	0.009	0.06	0.2
Western sagebrush lizard	0.0005	0	0	0
Western skink	0.006	0	0	0
Western terrestrial garter snake	0.05	0	0.02	0

Riparian habitat had the greatest diversity of reptiles found (Table 6-41). Eleven of the 14 species of reptiles were found in this type of habitat. The common garter snake, gopher snake, and western fence lizard were found in all five habitat types.

Table 6-41. Reptile Species Found in Each Habitat Type

Common Name	Riparian	Oak Woodland	Grassland	Farm Pond	Vernal Pool	Roads
Aquatic garter snake	X				X	
Common garter snake	X	X	X	X	X	
Common king snake	X		X	X		
Gopher snake	X	X	X	X	X	
Ring neck snake					X	
Sharp-tailed snake	X					
Southern Alligator lizard	X	X	X	X		
Western fence lizard	X	X	X	X	X	
Western pond turtle	X					
Western racer	X	X				
Western rattlesnake	X	X	X	X		X
Western Sagebrush lizard		X				
Western skink		X				
Western terrestrial garter snake	X	X		X		

Thomes-Newville Project

Surveys for reptiles at the Thomes-Newville Project were conducted from April 1981 through May 1982 at DWR's request to provide environmental information for water project planning. Reptile surveys were done by ground searching ponds and transects, seining, or night driving studies. Ground searches were done both day and night. Driving surveys were only done at night. Animals were identified using published identification keys. Pitfall trapping was also done in the Thomes-Newville Project area. A camera was used to photograph specimens for species verification and to maintain a general record of the find.

This survey produced observations of 15 reptile species that occur within the habitats in the project area and surrounding areas (Table 6-42). No estimate of population sizes was possible because of the small number of recaptures that occurred during the pitfall trapping.

Pitfall traps tended to be selective for lizards and smaller snakes, such as the sharp-tailed snake. Larger snakes, because of their length, could easily avoid falling into the traps. This trapping method failed to provide any reptile species not found by at least one other collection method.

Table 6-42. Observed Reptiles in the Thomes-Newville Project Area in 1982

Common Name	Scientific Name
Common garter snake	*Thamnophis sirtalis*
Common king snake	*Lampropeltis getulus*
Gopher snake	*Pituophis malanoleucus*
Sagebrush lizard	*Sceloperus graciosus*
Sharp-tailed snake	*Contia tenuis*
Southern alligator lizard	*Elgaria multicarinata*
Striped racer	*Masticophis lateralis*
Western aquatic garter snake	*Thamnophis couchi*
Western fence lizard	*Sceloperus occidentalis*
Western pond turtle	*Clemmys marmorata*
Western racer	*Coluber constrictor*
Western rattlesnake	*Crotalus viridis*
Western skink	*Eumeces skiltonianus*
Western terrestrial garter snake	*Thamnophis elegans*
Western whiptail	*Cnemidophorus tigris*

Western fence lizards were found in all habitat types (Table 6-43). Gopher snakes and western rattlesnakes were also found in most habitat types. The sagebrush lizards were much more limited in their distribution.

Table 6-43. Reptile Species Found in the Thomes-Newville Project Area in 1982

Species	Grassland	Chaparral	Oak Savannah	Pine-Oak Woodland	Riparian	Stream	Standing water
Common garter snake	X				X	X	X
Common king snake	X	X	X	X			
Gopher snake	X	X	X	X	X		
Sagebrush lizard		X					
Sharp-tailed snake	X	X					
Southern alligator lizard	X	X	X	X	X		
Striped racer	X	X					
Western aquatic garter snake					X	X	
Western fence lizard	X	X	X	X	X	X	X
Western pond turtle					X	X	X
Western racer	X	X	X		X		
Western rattlesnake	X	X	X	X	X		
Western skink	X	X	X				
Western terrestrial garter snake	X		X		X	X	X
Western whiptail		X	X	X			
Total number of species observed	**15**	**14**	**13**	**10**	**13**	**8**	**8**

Although no reptile species listed as rare or endangered was found in the Thomes-Newville project area, one species considered of special concern by the State of California is found throughout the inundation area. The western pond turtle occurs in streams coursing through the reservoir site. The presence of this species constitutes a significant finding.

Red Bank Project

Reptile surveys were conducted in the Red Bank Project area 1998. Surveys were done by ground searching near ponds, transects, seining, or night driving studies. Ground searches were done both day and night. Driving surveys were only done at night. Seining was done during the day. General reptile surveys were

conducted year-round throughout the Red Bank Project areas, when the weather was appropriate for reptile activity. A 1986 survey of the Red Bank Project area was also reviewed.

The objectives of the reptile surveys within the Red Bank Project area were to search for one species listed as federal and California species of special concern. This species, the western pond turtles, were found distributed throughout the study area.

During the 1998 studies, 11 species of reptiles were found (Table 6-44). The most significant finding of these studies was the discovery of western pond turtles, a California species of special concern. They were found in Red Bank Creek and South Fork Cottonwood Creek. The most common species of reptiles observed were western terrestrial garter snakes.

Table 6-44. Names and Abundance of Reptiles in the Red Bank Project Area

Common Name	Scientific Name	Cottonwood Creek	Red Bank Creek
		Catch per Hour	
Common garter snake	*Thamnophis sirtalis*	0.39	0.03
Common king snake	*Lampropeltis getulus*	0.01	0.01
Gopher snake	*Pituophis malanoleucus*	0.05	0.01
Southern alligator lizard	*Elgaria multicarinata*	0.02	0.01
Western fence lizard	*Sceloperus occidentalis*	0.14	0.08
Western pond turtle	*Clemmys marmorata*	0.17	0.09
Western racer	*Coluber mormon*	--	0.01
Western rattlesnake	*Crotalus viridis*	0.12	0.01
Western sagebrush lizard	*Sceloperus graciosus gracilis*	0.02	0.01
Western skink	*Eumeces skiltonianus*	0.01	0.03
Western terrestrial garter snake	*Thamnophis elegans*	0.15	0.13

Cultural Resources

The objectives of the cultural resource surveys at Sites Reservoir, Colusa Cell, and Red Bank Project were to obtain information about the archaeological sites comparable to the data from the survey conducted at Thomes-Newville Reservoir site in 1982, and to determine if there are cultural resource issues serious enough to remove a reservoir project from further consideration. Many new sites were identified and documented during the surveys representing a varied array of site types and almost all of the previously recorded sites were found again and documented to current standards. Archaeological evaluations of the proposed reservoirs yielded a wide range of variability in numbers and types of sites between projects, from three sites in one reservoir basin to more than 100 sites in another.

The reservoir assessments were based on record searches and field surveys. Database files, maps, and reports were reviewed at the Northeast, Northwest, and North Central Information Centers of the California Historical Resources

Information System, an adjunct of the State Office of Historic Preservation. The goal was to determine the extent of coverage of prior surveys within the project footprints and to obtain the records of any previously recorded sites. The field surveys concentrated on those areas with the highest potential for significant archaeological sites, such as stream terraces and level woodland flats, although areas of lesser sensitivity, such as steep hill slopes and arid plains, were also sampled.

Sites Reservoir

Parts of the Sites Reservoir area were surveyed in 1967 by a field class from the University of California, Los Angeles, and Chico State College, under agreement to the National Park Service. A total of 15 prehistoric sites was recorded at that time. No further work has been done within the reservoir footprint until the present study, which resulted in the discovery of 26 new archaeological sites. Of the 41 sites, at least 17 appear to be significant, in that they provisionally meet the criteria for eligibility to the National Register of Historic Places. Six of the sites are not eligible and 16 have undetermined status. An accurate assessment could not be made of these sites based solely on evidence visible on the surface. If further studies are warranted, a site testing program utilizing techniques such as small scale excavations, auger borings, and soil column sampling would be implemented to determine if the sites have archaeological values that meet the criteria for eligibility to the National Register.

Prehistoric settlement in the project area was constrained by the limited food and fuel resources and the scarcity of water; however, the area would have been important for seasonal hunting and gathering forays. The larger and more permanent villages were situated along the lower reaches of the bigger streams, in the Sacramento Valley, and on the knolls and natural levees along the Sacramento River.

Historic sites, features, and standing structures are significantly under-represented in the site totals. These resources were not recorded because they are associated with working ranches, occupied buildings, and the town site of Sites. A future survey of historic resources may yield an estimated 15 to 20 significant historic sites in addition to the Historic District of the Town of Sites. Moving the large cemetery associated with Sites and several smaller cemeteries would be costly and present special problems but there is precedent when associated with a major public works project. No cultural resource problems are known that would remove this reservoir project from further consideration.

Colusa Cell

The record search indicated that the footprint of the Colusa Cell had never been surveyed for cultural resources and that there were no site records in the files of the State database. The field survey indicated an even greater scarcity of subsistence resources than existed in the Sites Project area, and an ephemeral water supply that was not suitable for extensive use or habitation during the prehistoric past.

A total of three sites was recorded, two historic ranches and one site with a prehistoric and an historic component. The significance of the sites is undetermined. The assessment of eligibility to the National Register could not be

made on the basis of surface indications. Additional studies would be necessary to complete the evaluation. The Colusa Cell has no cultural resource issues that would preclude reservoir construction.

Thomes-Newville Project

A consultant for DWR completed a comprehensive survey of prehistoric sites within Thomes-Newville Reservoir in 1983. A total of 117 sites were recorded within the footprint of the proposed reservoir, representing a prehistoric settlement pattern that includes evidence of permanent or semi-permanent villages, seasonal campsites, and special resource procurement and use sites. The presence of perennial streams and availability of fuel and subsistence resources accounts for the intensive use of the project area during prehistoric times. Approximately 60 sites meet the criteria for eligibility to the National Register and would therefore qualify for some level of mitigation effort.

Historic features, sites, and standing structures are underrepresented in the site totals. These resources are now given the same consideration as prehistoric resources; however, that was not the case in the early 1980s when the survey was conducted. Additional survey work would be necessary to determine the number, type, and significance of the historic resources that are present.

As at Sites Reservoir, moving the historic cemeteries within the footprint of the Thomes-Newville Project would be costly and present special problems, but there are no cultural resource issues serious enough to remove this reservoir from consideration.

Red Bank Project

The record search for the Red Bank Project indicated that the project area had not been surveyed for cultural resources and no site records were present in the State database. The prior survey and excavations for the Red Bank Project conducted in the early 1950s by the University of California, Berkeley, for the National Park Service, was for a Sacramento River diversion project near Red Bluff that had the same name. The surveys completed in 1994 by California State University, Sacramento, for the Corps' Cottonwood Creek Project, were downstream of the current proposed project, with no overlap of the footprints.

A total of 31 sites were recorded within the footprint of three of the four reservoirs comprising the Red Bank Project; no sites were found at one reservoir. Twenty-eight sites are prehistoric and three are historic. Nine sites appear to meet the criteria for eligibility to the National Register, 16 sites are of undeterminable significance without further work, and 6 sites are not eligible for listing on the National Register, and are therefore not significant.

The prehistoric sites in the Red Bank Project were generally small and the artifact distribution relatively sparse. The sites were probably associated with seasonal upland hunting, fishing, and gathering activities. The larger permanent settlements were situated further downstream on the banks of the perennial streams and along the Sacramento River.

No issues were identified as a result of the survey of the Red Bank Project that were serious enough to prevent construction of the reservoirs.

Table 6-45. Probability of Occurrence and Listing Status of Animal and Plant Species Evaluated

Species	Status[1]			Occurrence Probability within Reservoir Sites [2]				
Scientific Name (Common Name)	Federal	State	Other	Sites	Funks	Colusa	Thomes-Newville	Red Bank
Invertebrates								
Desmocerus californicus dimorphus (valley elderberry longhorn beetle)	FT	none	none	X	X	X	X	X
Lepidurus packardi (vernal pool tadpole shrimp)	FE	none	none	*	*	*	*	-
Branchinecta lynchi (vernal pool fairy shrimp)	FT	none	none	*	*	*	*	-
Branchinecta conservatio (Conservancy fairy shrimp)	FE	none	none	*	*	*	*	-
Anthicus antiochensis (Antioch Dunes anthicid beetle)	FSC	none	none	-	-	-	-	-
Anthicus sacramento (Sacramento anthicid beetle)	FSC	none	none	-	-	-	-	-
Dubiraphia brunnescens (brownish dubiraphian riffle beetle)	FSC	none	none	-	-	-	-	-
Ochthebius reticulatus (Wilbur Springs minute moss beetle)	FSC	none	none	-	-	-	-	-
Paracoenia calida (Wilbur Springs shore fly)	FSC	none	none	-	-	-	-	-
Hydroporus leechi (Leech's skyline diving beetle)	FSC	none	none	-	-	-	-	-
Amphibian								
Ambystoma californiense (California tiger salamander)	FC	DFG	none	-	-	-	-	-
Rana aurora ssp. draytonii (California red-legged frog)	FT	CSC,DFG	none	-	-	-	-	X
Rana boylii (Foothill yellow-legged frog)	FSC	CSC,DFG	none	-	-	-	*	X
Scaphiopus hammondii	none	DFG	none	*	-	*	X	*

Species	Status[1]			Occurrence Probability within Reservoir Sites [2]				
Scientific Name (Common Name)	Federal	State	Other	Sites	Funks	Colusa	Thomes-Newville	Red Bank
(western spadefoot toad)								
Fish								
Lampetra tridentata (Pacific lamprey)	FSC	none	none	*	*	*	X	X
Mylopharodon conocephalus (Hardhead)	FS	CSC	none	X	X	X	X	X
Oncorhynchus mykiss (Steelhead)	FT	none	none	-	-	-	X	X
Oncorhynchus tshawytscha (Late fall-run Chinook salmon)	FPT	CSC	none	-	-	-	-	-
Oncorhynchus tshawytscha (Spring-run Chinook salmon)	FPE,FS	ST	none	X	-	-	X	X
Pogonichthys macrolepidotus (Splitail)	FE	SE	none	-	*	-	-	-
Reptile								
Clemmys marmorata ssp. marmorata (Northwestern pond turtle)	FSC	CSC,DFG	none	X	X	X	X	X
Phrynosoma coronatum ssp. frontale (California horned lizard)	FSC	CSC,DFG	none	*	-	*	*	-
Thamnophis gigas (Giant garter snake)	FT	ST,DFG	none	-	*	-	-	-
Birds								
Accipiter cooperii (Cooper's hawk)	none	CSC	none	X	X	X	X	X
Accipiter gentilis (Northern goshawk)	None	CSC	SC	-	-	-	-	-
Accipiter striatus (Sharp-shinned hawk)	none	CSC	none	X	X	X	*	X
Agelaius tricolor (Tri-colored blackbird)	none	CSC	SC	X	*	X	X	-
Ammodramus savannarum (Grasshopper sparrow)	none	CSC	CS	*	X	X	*	*

Species	Status[1]			Occurrence Probability within Reservoir Sites [2]				
Scientific Name (Common Name)	Federal	State	Other	Sites	Funks	Colusa	Thomes-Newville	Red Bank
Amphispiza belli ssp. belli (Bell's sage sparrow)	none	CSC	SC	-	-	-	*	-
Aquila chrysaetos (Golden eagle)	PR	CSC,CFP	none	X	X	X	X	X
Asio flammeus (Short-eared owl)	none	CSC	none	*	*	X	*	*
Asio otus (Long -eared owl)	none	CSC	none	X	*	X	X	X
Athene cunicularia (Burrowing owl)	FSC	CSC	none	X	X	X	X	*
Botaurus lentiginosus (American bittern)	MNBMC	none	none	*	X	*	*	*
Branta canadensis ssp. leucopareia (Aleutian Canada goose)	FT	none	none	-	*	-	-	-
Bucephala islandica (Barrow's goldeneye)	none	CSC	none	-	*	-	-	*
Buteo regalis (Ferruginous hawk)	none	CSC	SC	X	X	*	*	-
Buteo swainsoni (Swainson's hawk)	none	ST	none	*	*	*	*	-
Carduelis lawrencei (Lawrence's goldfinch)	MNBMC	none	none	*	X	X	*	X
Chaetura vauxi (Vaux's swift)	MNBMC	CSC	none	*	*	*	*	*
Charadrius semipalmatus (Western snowy plover)	FT	CSC	none	-	-	-	-	-
Charadrius montanus (Mountain plover)	PLT	CSC	none	*	-	*	*	-
Chondestes grammacus (Lark sparrow)	MNBMC	none	none	X	X	X	X	X
Circus cyaneus (Northern harrier)	none	CSC	none	X	X	X	X	X
Coccyzus americanus ssp. occidentalis (Western yellow-billed cuckoo)	none	SE	none	-	-	-	-	-

Species	Status[1]			Occurrence Probability within Reservoir Sites [2]				
Scientific Name (Common Name)	Federal	State	Other	Sites	Funks	Colusa	Thomes-Newville	Red Bank
Dendroica occidentalis (Hermit warbler)	MNBMC	none	none	*	*	*	*	*
Dendroica petechia (Yellow-warbler)	none	CSC	none	X	-	-	-	-
Elanus caeruleus (White-tailed kite)	none	none	none	X	X	*	*	*
Empidonax traillii (Willow flycatcher)	none	SE	none	-	-	-	-	-
Eremophila alpestris ssp. actia (California horned lark)	none	none	SC	X	X	X	X	X
Falco columbarius (Merlin)	none	CSC	none	X	*	*	X	X
Falco mexicanus (Prarie falcon)	none	CSC	none	X	X	X	X	X
Falco peregrinus (Peregrine falcon)	FE	SE	none	*	*	*	*	*
Gavia immer (Common loon)	MNBMC	CSC	none	-	X	-	-	*
Mammals								
Antrozous pallidus (Pallid bat)	FS	CSC	none	X	NE	*	X	*
Bassariscus astutus (Ringtail)	none	CFP	none	X	NE	*	X	X
Corynorhinus townsendii ssp. pallescens (Pale big-eared bat)	FSC,FS	CSC	none	*	NE	*	*	*
Corynorhinus townsendii ssp. townsendii (Pacific western big-eared bat)	FS,FSC	CSC	none	*	NE	*	*	*
Euderma maculatum (Spotted bat)	FSC	CSC	none	-	NE	-	-	-
Eumops perotis californicus (Western mastiff bat)	FSC	CSC	none	-	NE	-	*	*
Lasiurus blossivillii (Western red bat)	FS	none	none	X	NE	*	*	X

Species	Status[1]			Occurrence Probability within Reservoir Sites [2]				
Scientific Name (Common Name)	Federal	State	Other	Sites	Funks	Colusa	Thomes-Newville	Red Bank
Martes americana (Pine marten)	FS	none	none	*	NE	*	*	*
Martes pennanti ssp. pacificus (Pacific fisher)	FSC,FS	CSC	none	*	NE	*	*	*
Myotis ciliolabrum (Small-footed myotis)	FSC	none	none	*	NE	*	*	*
Myotis evotis (Long-eared myotis)	FSC	none	none	*	NE	*	*	*
Myotis thysanodes (Fringed myotis)	FSC	none	none	-	NE	-	*	*
Myotis volans (Long-legged myotis)	FSC	none	none	-	NE	-	*	*
Myotis yumanensis (Yuma myotis)	FSC	CSC	none	*	NE	*	*	X
Perognathus inornatus ssp. inornatus (San Joaquin pocket mouse)	FSC	CSC	none	*	NE	*	*	-
Taxidea taxus (American badger)	none	CSC	none	X	NE	X	*	*
Plants								
Antirrhinum subcordatum (Dimorphic snapdragon)	none	none	1B	*	NE	*	X	X
Asclepias solanoana (Serpentine milkweed)	none	none	1B	-	NE	-	-	-
Astragalus rattanii var. jepsonianus (Jepson's milk-vetch)	none	none	1B	-	NE	-	X	X
Astragalus tener var. ferrisiae (Ferris's milk-vetch)	FSC	none	1B	*	NE	*	*	*
Atriplex cordulata (Heartscale)	FSC	none	1B	*	NE	*	*	*
Atriplex depressa (Brittlescale)	FSC	none	1B	*	NE	*	*	*
Atriplex joaquiniana (San Joaquin spearscale)	FSC	none	1B	*	NE	*	*	*

Species	Status[1]			Occurrence Probability within Reservoir Sites [2]				
Scientific Name (Common Name)	Federal	State	Other	Sites	Funks	Colusa	Thomes-Newville	Red Bank
Atriplex persistens (Vernal pool saltbush)	none	none	1B	*	NE	*	*	-
Balsamorhiza macrolepis var. macrolepis (Big-scale balsamroot)	none	none	1B	*	NE	*	*	*
Brodiaea coronaria ssp. rosea (Indian Valley broadiaea)	FSC	SE	1B	*	NE	*	*	*
Chamaesyce hooveri (Hoovers spurge)	FT	none	1B	*	NE	*	*	-
Cordylanthus palmatus (Palmate-bracted bird's-beak)	FE	SE	1B	*	NE	*	*	-
Cryptantha crinita (Silky cryptantha)	none	none	1B	*	NE	*	*	*
Delphinium recurvatum (Recurved larkspur)	none	none	1B	*	NE	*	*	*
Eleocharis quadrangulata (Four-angled spikerush)	none	none	2	*	NE	*	*	-
Eriastrum brandegeae (Brandegee's eriastrum)	FSC	none	1B	-	NE	-	*	X
Eschscholzia rhombipetala (Diamond-petaled California poppy)	FSC	none	1A	*	NE	*	*	*
Fritillaria pluriflora (Adobe lilly)	FSC	none	1B	*	NE	*	X	X
Gratiola heterosepala (Bogg's Lake hedge-hyssop)	none	SE	1B	*	NE	*	*	*
Hesperevax acaulis var. acaulis (Dwarf evax)	none	none	1B	*	NE	*	*	*
Hesperolinon drymarioides (Drymaria-like western flax)	FSC	none	1B	-	NE	-	*	*
Hesperolinon tehamense (Tehama Co. western flax)	FSC	none	1B	-	NE	-	X	*
Juncus leiospermus var. leiospermus (Red Bluff dwarf rush)	none	none	1B	*	NE	*	*	*
Layia septentrionalis (Colusa layia)	none	none	1B	*	NE	*	*	*

Species	Status[1]			Occurrence Probability within Reservoir Sites [2]				
Scientific Name (Common Name)	Federal	State	Other	Sites	Funks	Colusa	Thomes-Newville	Red Bank
Legenere limosa (Legenere)	none	none	1B	*	NE	*	*	-
Lepidium latipes var. heckardii (Heckard's pepper-grass)	none	none	1B	*	NE	*	*	*
Lotus rubriflorus (Red-flowered lotus)	FSC	none	1B	*	NE	*	*	*
Lupinus milo-bakeri (Milo Baker's lupine)	FSC	ST	1B	*	NE	*	*	*
Lupinus sericatus (Cobb Mountain lupine)	none	none	1B	-	NE	-	*	*
Madia hallii (Hall's madia)	FSC	none	1B	-	NE	-	*	*
Madia stebbinsii (Stebbin's madia)	none	none	1B	-	NE	-	*	*
Microseris sylvatica (Woodland mocroseris)	none	none	3	*	NE	*	*	*
Myosurus minimus var. apus (Little mouse tail)	FSC	none	3	*	NE	*	*	-
Myosurus sessilis (Sessile mousetail)	none	none	3	*	NE	*	*	*
Neostaphia colusana (Colusa grass)	FT	SE	1B	*	NE	*	*	-
Orcuttia pilosa (Hairy Orcutt grass)	FT	SE	1B	*	NE	*	*	-
Orcuttia tenuis (Slender Orcutt grass)	PT	SE	1B	*	NE	*	*	-
Paronychia ahartii (Ahart's paronychia)	FSC	none	1B	*	NE	*	*	*
Sagittaria sanfordii (Sandford's arrowhead)	FSC	none	1B	*	NE	*	*	*
Silene campanulata var. campanulata (Red mountain catchfly)	FC	SE	1B	*	NE	*	*	*
Streptanthus morrisonii (Morrison's jewel flower)	FSC	none	1B	-	NE	-	*	-

Species	Status[1]			Occurrence Probability within Reservoir Sites [2]				
Scientific Name (Common Name)	Federal	State	Other	Sites	Funks	Colusa	Thomes-Newville	Red Bank
Trichocoronis wrightii var. wrightii (Wright's trichocoronis)	none	none	2	*	NE	*	*	-
Tropidocarpum capparideum (Caper-fruited tropidocarpum)	FSC	none	1B	*	NE	*	*	*
Tuctoria greenei (Green's tuctoria)	FE	CR	1B	*	NE	*	*	-
Viburnum ellipticum (Western viburnum)	none	none	3	-	NE	-	*	*

Foot note#1

Status Key

1A=Presumed to be extinct in California (California Native Plant Society)
1B=Rare, Threatened or Endangered in California and elsewhere (California Native Plant Society)
2=Rare,Threatened or endangered in California but more common elsewhere
3=More information is needed
CFP=Fully protected under California Fish and Game
CR=State Listed as rare (Section1904, DFG code 1994)
CSC=California Species of Special Concern
DFG=California Department of Fish and Game Protected
FC=Federal Candidate Species
FE=Federally Endangered
FPE=Federally Proposed for listing as endangered
FPT=Federally Proposed as threatened
FS=Forest Service Sensitive Species
FSC=Federal Special Concern Species
FT=Federally Threatened
MNBMC=Migratory non-game bird of management concern (USFWS)
PLT=Proposed for listing as threatened under ESA
PR=Protected under the Bald Eagle Act
PT=Federally Proposed, threatened

Species	Status[1]			Occurrence Probability within Reservoir Sites [2]				
Scientific Name (Common Name)	Federal	State	Other	Sites	Funks	Colusa	Thomes-Newville	Red Bank

SB=Specified birds under California Fish and Game Code
SC=Other species of concern identified by CALFED
SE=State endangered
ST=State threatened

Foot note #2
Includes species that have been observed in survey efforts and the probability of species that may be present in the area, based on preliminary habitat evaluations, but have not been observed to date.

Occurrence Probability Key

X=Observed in the reservoir footprint or within 1 mile of it
*=Not observed to date but potential habitat exists in the reservoir footprint or within 1 mile of it
-=Not observed and not likely to occur in the reservoir footprint or within 1 mile of it
NE=Not evaluated in inundation area studies, see site 1-mile perimeter column for potential occurrence at Funks Reservior.